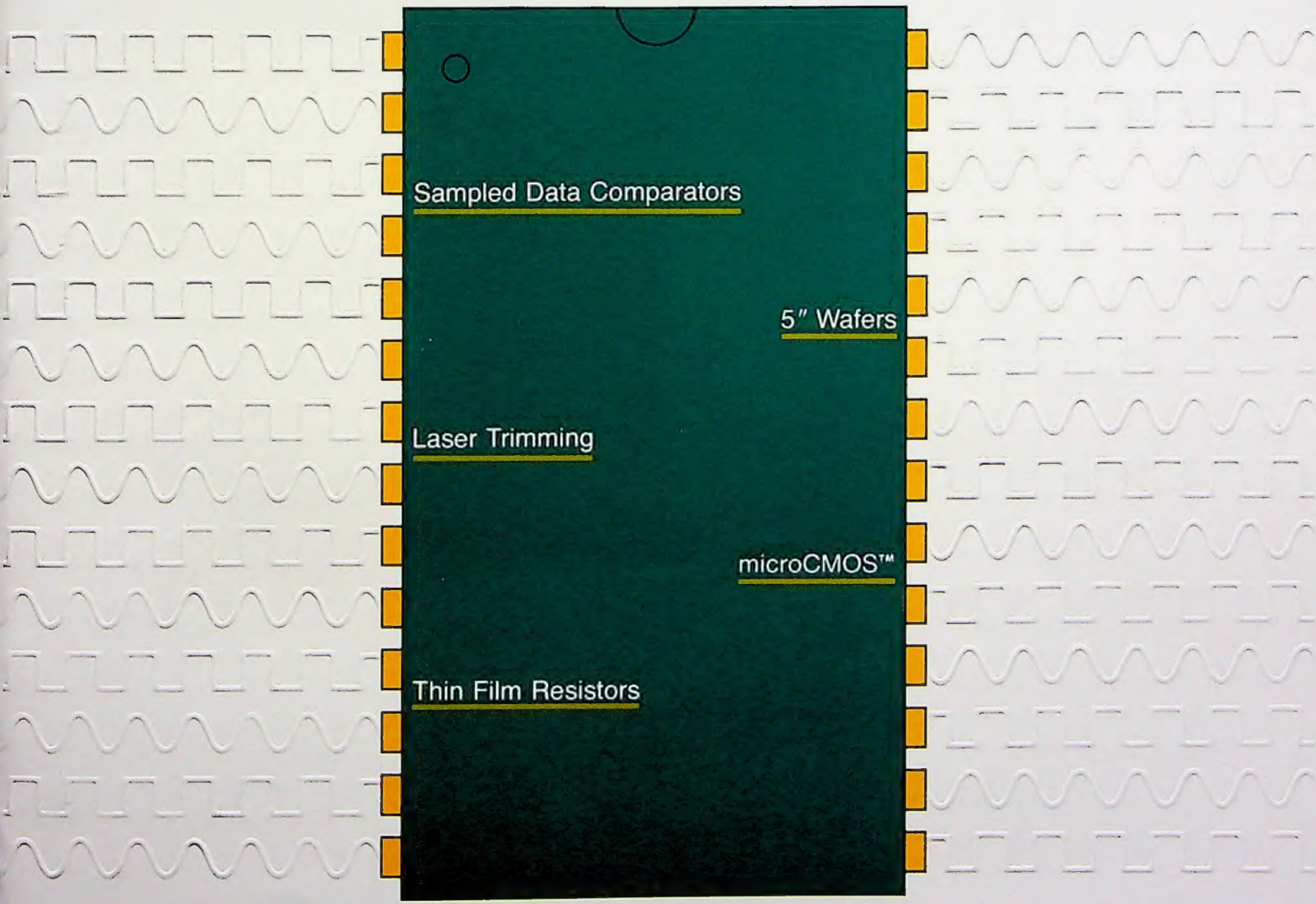
National
Semiconductor
Corporation

Data Conversion/ Acquisition Products



Five advanced technologies yield the best cost/ performance in A/Ds and D/As.

Thin-film resistors, laser trimming, sampled data comparators, microCMOS, and 5" wafers lead the list of technological advances that add up to the utmost in data acquisition cost/performance.

Good cost performance means designing and producing the lowest cost A/Ds and D/As for the performance levels that are in greatest demand.

To do this, only National utilizes all five of these advanced design and production technologies: thin-film resistors, laser trimming, sampled data comparators, microCMOS, patterned packages, and 5-inch wafers.

Laser-trimmed thin-film resistors. By incorporating laser-trimmed thin-film resistors, the 10- and 12-bit A/Ds and D/As offer unsurpassed precision and temperature coefficients.

Sampled data comparators eliminate A/D design flaws. Many of National's A/Ds also utilize sampled data comparators. The result: high speed at low overdrive is designed into each chip, with oscillations, noise, and offset designed out.

microCMOS: higher speed, lower cost. microCMOS, National's own double-poly, gate process, increases device speeds in several ways.

For example, microCMOS features shallow junction depths which reduce junction capacitance. Also, the higher circuit density afforded by two levels of interconnect provides higher speeds at lower cost.

5-inch wafers: yields go up, unit costs go down. Further advancing the leading edge of production technology, National's unique five-inch wafer lines are driving unit costs straight through the floor.

When it comes to Data Acquisition, National is synonymous with cost/performance.

Foreword

This product guide provides an overview of the data acquisition and conversion products manufactured by National Semiconductor. Products included are those devices in the direct analog signal path, before and after digital conversion.

Detailed information is contained in National's Data Conversion/Acquisition Databook and other National data books. To order these publications write to us for the Data Bookshelf Order Form.

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A/D Converter Selection Guide

Part No.	Resolution (Bits)	Absolute Accuracy (Max)	Conversion Time	Input Voltage Range	Output Logic Levels	Supplies (V)	Temperature Range* M	I	C	Package	Comments
A/D CONVERTER											
ADC0800	8	±2 LSB	50 μs	±5V	TTL, TRI-STATE	+5, −12	•		•	18-Pin DIP	
ADC0801	8	±¼ LSB	110 μs	5V	TTL, TRI-STATE	+5	•	•	•	20-Pin DIP	Differential Input
ADC0802	8	±½ LSB	110 μs	5V	TTL, TRI-STATE	+5	•	•	•	20-Pin DIP	Differential Input
ADC0803	8	±½ LSB	110 μs	5V	TTL, TRI-STATE	+5		•	•	20-Pin DIP	Differential Input
ADC0804	8	±1 LSB	110 μs	5V	TTL, TRI-STATE	+5		•	•	20-Pin DIP	Differential Input
ADC0805	8	±1 LSB	110 μs	5V	TTL, TRI-STATE	+5		•	•	20-Pin DIP	Ratiometric Operation
ADC0808	8	±½ LSB	100 μs	5V	TTL, TRI-STATE	+5	•	•	•	28-Pin DIP	8-Channel MUX
ADC0809	8	±1 LSB	100 μs	5V	TTL, TRI-STATE	+5		•	•	28-Pin DIP	8-Channel MUX
ADC0811B	8	±½ LSB	32 μs	5V	TTL	+5		•	•	20-Pin DIP	11-Channel Serial I/O
ADC0811C	8	±1 LSB	32 μs	5V	TTL	+5		•	•	20-Pin DIP	11-Channel Serial I/O
ADC0816	8	±½ LSB	100 μs	5V	TTL, TRI-STATE	+5	•	•	•	40-Pin DIP	16-Channel MUX
ADC0817	8	±1 LSB	100 μs	5V	TTL, TRI-STATE	+5		•	•	40-Pin DIP	16-Channel MUX
ADC0820B	8	±½ LSB	1.2 μs	5V	TTL, TRI-STATE	+5		•	•	20-Pin DIP	Built-in Track and Hold Function
ADC0820C	8	±1 LSB	1.2 μs	5V	TTL, TRI-STATE	+5		•	•	20-Pin DIP	Built-in Track and Hold Function
ADC0829B	8	±½ LSB	100 μs	5V	TTL, TRI-STATE	+5		•	•	28-Pin DIP	Additional Digital Input Capability
ADC0829C	8	±1 LSB	100 μs	5V	TTL, TRI-STATE	+5		•	•	28-Pin DIP	Additional Digital Input Capability
ADC0830B	8	±½ LSB	100 μs	5V	TTL, TRI-STATE	+5		•	•	40-Pin DIP	Additional Digital Input Capability
ADC0830C	8	±1 LSB	100 μs	5V	TTL, TRI-STATE	+5		•	•	40-Pin DIP	Additional Digital Input Capability
ADC0831B	8	±½ LSB	32 μs	5V	TTL	+5		•	•	8-Pin DIP	Serial I/O
ADC0831C	8	±1 LSB	32 μs	5V	TTL	+5		•	•	8-Pin DIP	Serial I/O
ADC0832B	8	±½ LSB	32 μs	5V	TTL	+5		•	•	8-Pin DIP	2-Channel Serial I/O
ADC0832C	8	±1 LSB	32 μs	5V	TTL	+5		•	•	8-Pin DIP	2-Channel Serial I/O
ADC0833B	8	±½ LSB	32 μs	5V	TTL	+5 to +9		•	•	14-Pin DIP	4-Channel Serial I/O
ADC0833C	8	±1 LSB	32 μs	5V	TTL	+5 to +9		•	•	14-Pin DIP	4-Channel Serial I/O
ADC0834B	8	±½ LSB	32 μs	5V	TTL	+5 to +9		•	•	14-Pin DIP	4-Channel Serial I/O
ADC0834C	8	±1 LSB	32 μs	5V	TTL	+5 to +9		•	•	14-Pin DIP	4-Channel Serial I/O
ADC0838B	8	±½ LSB	32 μs	5V	TTL	+5 to +9		•	•	20-Pin DIP	8-Channel Serial I/O
ADC0838C	8	±1 LSB	32 μs	5V	TTL	+5 to +9		•	•	20-Pin DIP	8-Channel Serial I/O

A/D Converter Selection Guide (continued)

Part No.	Resolution (Bits)	Absolute Accuracy (Max)	Conversion Time	Input Voltage Range	Output Logic Levels	Supplies (V)	Temperature Range* M	I	C	Package	Comments
A/D CONVERTER											
†ADC0840B	8	±½ LSB	32 μs	5V	TTL, TRI-STATE	+5		•	•	20-Pin DIP	Differential Input
†ADC0840C	8	±1 LSB	32 μs	5V	TTL, TRI-STATE	+5		•	•	20-Pin DIP	Differential Input
†ADC0841B	8	±½ LSB	40 μs	5V	TTL, TRI-STATE	+5		•	•	20-Pin DIP	Differential Input, Internal Clock
†ADC0841C	8	±1 LSB	40 μs	5V	TTL, TRI-STATE	+5		•	•	20-Pin DIP	Differential Input, Internal Clock
ADC0844B	8	±½ LSB	40 μs	5V	TTL, TRI-STATE	+5		•	•	20-Pin DIP	4-Channel MUX, Internal Clock
ADC0844C	8	±1 LSB	40 μs	5V	TTL, TRI-STATE	+5		•	•	20-Pin DIP	4-Channel MUX, Internal Clock
†ADC1001B	10	±½ LSB	50 μs	5V	TTL, TRI-STATE	+5		•	•	20-Pin DIP	8-Bit Bus Compatible, Differential Input
†ADC1001C	10	±1 LSB	50 μs	5V	TTL, TRI-STATE	+5		•	•	20-Pin DIP	8-Bit Bus Compatible, Differential Input
†ADC1005B	10	±½ LSB	50 μs	5V	TTL, TRI-STATE	+5		•	•	20-Pin DIP	8-Bit Bus Compatible, Differential Input
†ADC1005C	10	±1 LSB	50 μs	5V	TTL, TRI-STATE	+5		•	•	20-Pin DIP	8-Bit Bus Compatible, Differential Input
†ADC1021B	10	±½ LSB	50 μs	5V	TTL, TRI-STATE	+5		•	•	24-Pin DIP	Differential Input
†ADC1021C	10	±1 LSB	50 μs	5V	TTL, TRI-STATE	+5		•	•	24-Pin DIP	Differential Input
†ADC1025B	10	±½ LSB	50 μs	5V	TTL, TRI-STATE	+5		•	•	24-Pin DIP	Differential Input
†ADC1025C	10	±1 LSB	50 μs	5V	TTL, TRI-STATE	+5		•	•	24-Pin DIP	Differential Input
†ADC1205B	12+sign	±½ LSB	100 μs	±5V	TTL, TRI-STATE	+5, ±5	•		•	24-Pin DIP	8-Bit Bus Compatible, Differential Input
†ADC1205C	12+sign	±1 LSB	100 μs	±5V	TTL, TRI-STATE	+5, ±5	•		•	24-Pin DIP	8-Bit Bus Compatible, Differential Input
ADC1210	12	±¾ LSB	200 μs	10.2V	CMOS	+5 to ±15	•	•		24-Pin DIP	
ADC1211	12	±2 LSB	200 μs	10.2V	CMOS	+5 to ±15	•	•		24-Pin DIP	
†ADC1225B	12+sign	±½ LSB	100 μs	±5V	TTL, TRI-STATE	+5, ±5	•		•	28-Pin DIP	Differential Input
†ADC1225C	12+sign	±1 LSB	100 μs	±5V	TTL, TRI-STATE	+5, ±5	•		•	28-Pin DIP	Differential Input
ADC3511	3½-Digit	0.05%	200 ms	2V	TTL, TRI-STATE	+5			•	24-Pin DIP	Integrating μP Compatible
ADC3711	3¾-Digit	0.05%	400 ms	2V	TTL, TRI-STATE	+5			•	24-Pin DIP	Integrating μP Compatible
LM131	V-F	0.01%	N/A	V_{CC}−2V	Open Collector	+5 to +40	•	•	•	8-Pin DIP or TO-99 Can	Voltage-to-Frequency Converter 100 kHz Max
DIGITAL VOLTMETER											
ADD3501	3½-Digit	0.05%	200 ms	2V	7-Segment LED Drive	+5			•	28-Pin DIP	3½-Digit LED DVM
ADD3701	3¾-Digit	0.05%	400 ms	2V	7-Segment LED Drive	+5			•	28-Pin DIP	3¾-Digit LED DVM

*Temperature ranges are: "M" is −55°C to +125°C ambient; "I" is −40°C to +85°C or −25°C to +85°C; "C" is 0°C to 70°C.
†Product to be announced.

ADC0801, ADC0802, ADC0803, ADC0804, ADC0805, ADC0808, ADC0809, ADC0816, ADC0817
8-Bit Microprocessor Compatible A/D Converters with Multiplexer Options

General Description

These successive approximation A/D converters are designed to operate directly with a microprocessor control bus and directly drive data bus with the TRI-STATE® output latches. These A/Ds appear like memory locations or I/O ports to the microprocessor. These converters feature a high impedance sampled data comparator eliminating the need for external zero and full scale adjustments.

The ADC0801, ADC0802, ADC0803, ADC0804, and ADC0805 feature a differential analog voltage input for increasing the common-mode rejection and offsetting the analog zero input voltage value. The 8-channel multiplexer of the ADC0808 and ADC0809 can directly access any one of 8 single-ended analog signals, while the ADC0816 and ADC0817 16-channel multiplexer can directly access any one of 16 single-ended analog signals and provides this direct access to the input of the A/D converter for signal conditioning.

The features of these devices make them ideally suited to applications from process control and machine control to consumer and automotive applications.

Key Specifications

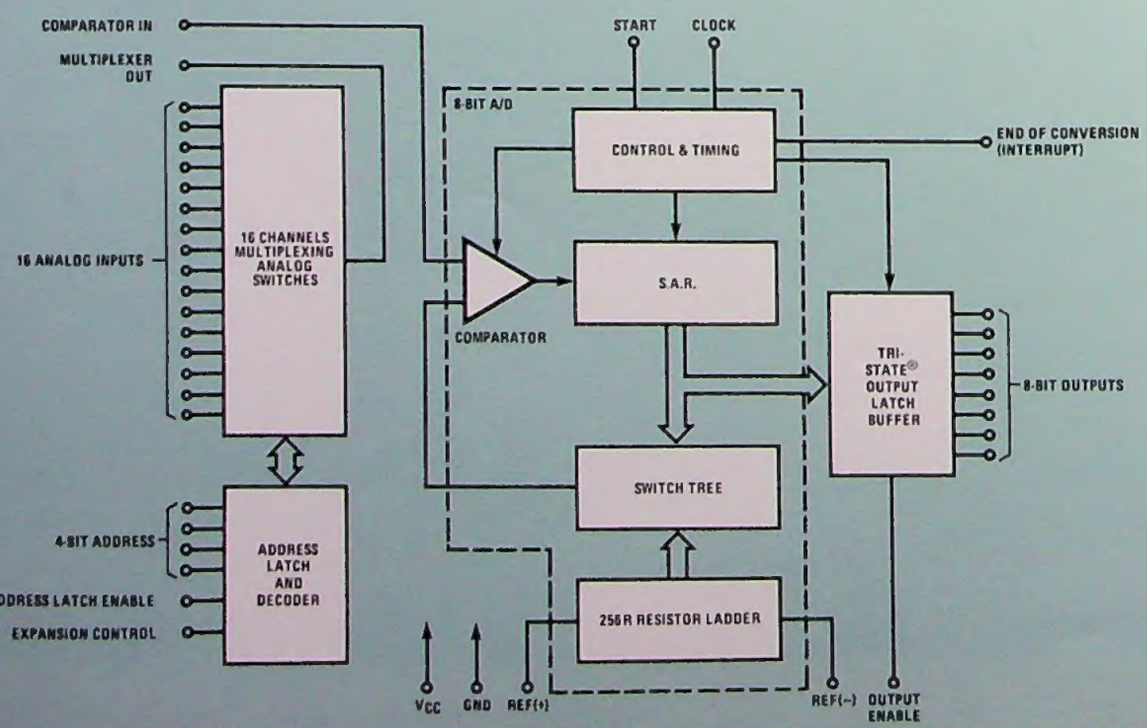
- Resolution—8 Bits
- Total Unadjusted Error—±½ LSB and ±1 LSB
- Conversion Time—100 μs
- Low Cost

Features

- No zero or full-scale adjust required
- 0V to 5V analog input voltage range with single 5V supply
- Operates ratiometrically or with fixed voltage reference
- Differential analog voltage inputs—ADC0801, ADC0802, ADC0803, ADC0804, ADC0805
- Multiplexer with latched control logic—ADC0808, ADC0809, ADC0816, ADC0817
- Easy interface to all microprocessors, or operates "stand alone"
- Outputs meet TLL voltage level specification
- Standard hermetic or molded 20-pin, 28-pin, and 40-pin DIP package
- Low power consumption—15mW
- Latched TRI-STATE® output

Block Diagrams

ADC0808 and ADC0809



ADC0820, 8-Bit High-Speed μP Compatible A/D Converter with Track/Hold Function

General Description

The ADC0820 is a microCMOS 8-bit A/D converter which uses a half-flash technique consisting of 32 comparators, a most significant 4-bit ADC and a least significant 4-bit ADC.

This converter's input acquisition time is much faster than its conversion time and is capable of measuring many analog signals without the aid of a sample-and-hold.

This A/D is designed to appear as a memory location or I/O port to the microprocessor with no interfacing logic needed.

Key Specifications

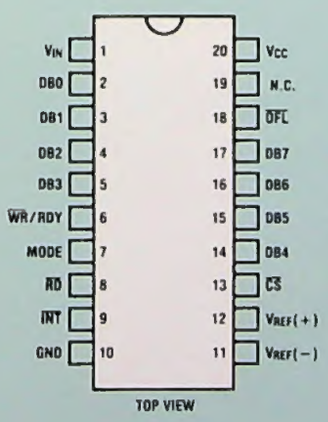
- Resolution—8 Bits
- Conversion Time—2.5 μs Max (RD Mode)
  1.5 μs Max (WR-RD Mode)
- Input signals with slew rate of 100 mV/μs converted without external sample-and-hold to 8 bits
- Low Power—75 mW
- Total Unadjusted Error—±½ LSB and ±1 LSB

Features

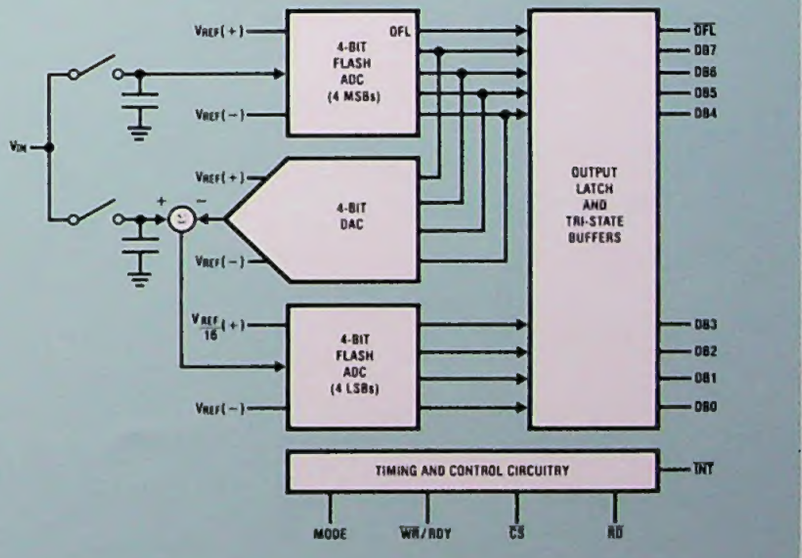
- Built-in track-and-hold function
- No missing codes
- No external clocking
- Easy interface to all microprocessors, or operates stand-alone
- Logic inputs and outputs meet both MOS and T^2L voltage level specifications
- Operates ratiometrically or with any reference value equal to or less than V_{CC}.
- 0V to 5V analog input voltage range with single 5V supply
- No zero or full-scale adjust required
- Overflow output available for cascading
- 0.3" standard width 20-pin DIP

Connection Diagram

Dual-In-Line Package



Functional Diagram



ADC0831, ADC0832, ADC0834 and ADC0838 (COP431, COP432, COP434 and COP438) 8-Bit Serial I/O A/D Converters with Multiplexer Options

General Description

The ADC0831 series are 8-bit successive approximation A/D converters with a serial I/O and configurable input multiplexers with up to 8 channels. The serial I/O is configured to comply with the NSC MICROWIRE™ serial data exchange standard for easy interface to the COPS™ family of processors, and can interface with standard shift registers or μPs.

The 2-, 4- or 8-channel multiplexers are software configured for single-ended or differential inputs as well as channel assignment.

The differential analog voltage input allows increasing the common-mode rejection and offsetting the analog zero input voltage value. In addition, the voltage reference input can be adjusted to allow encoding smaller analog voltage span to the full 8 bits of resolution.

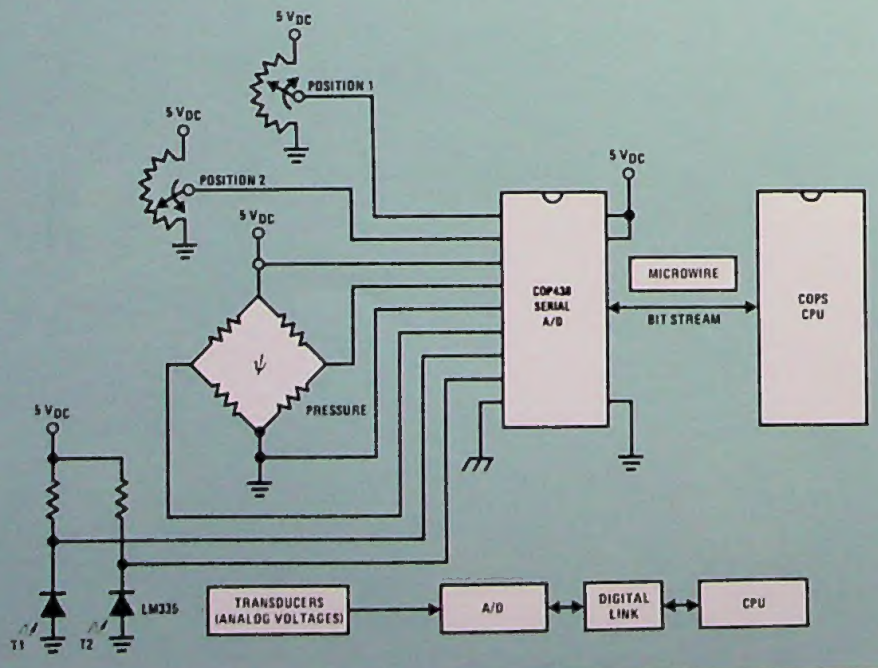
Features

- NSC MICROWIRE compatible—direct interface to COPS family processors
- Easy interface to all serial I/O microprocessors, or operates "stand-alone"
- Operates ratiometrically or with 5 V_{DC} voltage reference
- No zero or full-scale adjust required
- 2-, 4- or 8-channel multiplexer options with address logic
- Shunt regulator allows operation with high voltage supplies
- 0V to 5V input range with single 5V power supply
- Remote operation with serial digital data link
- T^2L/MOS input/output compatible
- 0.3" standard width 8-, 14- or 20-pin DIP package

Key Specifications

- Resolution—8 Bits
- Total Unadjusted Error—±½ LSB and ±1 LSB
- Single Supply—5 V_{DC}
- Low Power—15 mW
- Conversion Time—32 μs

Typical Application



ADC0844 8-Bit μP Compatible A/D Converter with 4-Channel Multiplexer

General Description

The ADC0844 is a CMOS 8-bit successive approximation A/D converter with a versatile analog input multiplexer. The 4-channel multiplexer can be software configured for single-ended, differential or pseudo-differential modes of operation.

This A/D is designed to operate from the control bus of a wide variety of 8080 μP derivatives including the NSC800™. TRI-STATE® output latches that directly drive the data bus permit this A/D to be configured as a memory location or as an I/O device to the microprocessor with no interface logic necessary. No external clock is required.

The differential analog voltage input allows increasing the common-mode rejection and offsetting the analog zero input voltage value. In addition, the voltage reference input can be adjusted to allow encoding smaller analog voltage span to the full 8 bits of resolution.

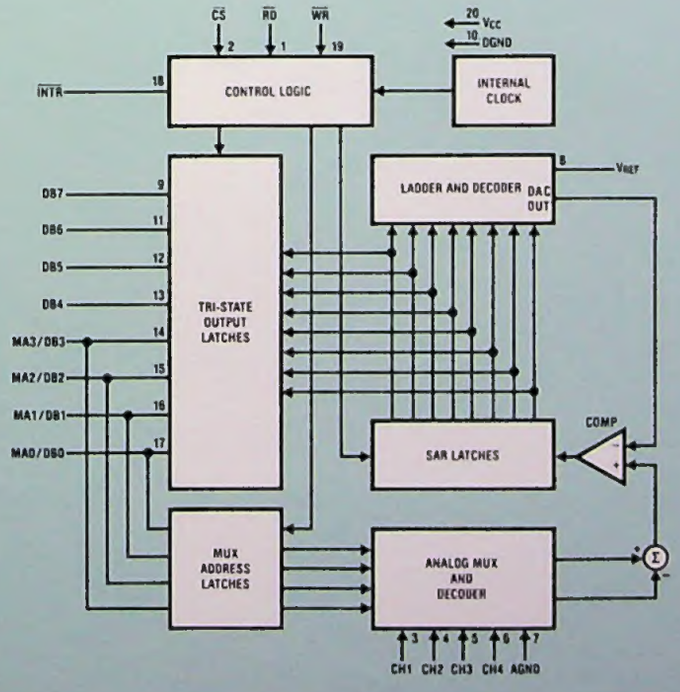
Key Specifications

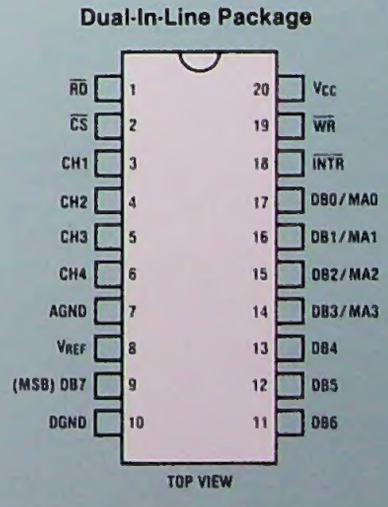
- Resolution—8 Bits
- Total Unadjusted Error—±½ LSB and ±1 LSB
- Single Supply—5 V_{DC}
- Low Power—10 mW
- Conversion Time—40 μs

Features

- Compatible with 8080 μP derivatives—no interface logic needed
- Easy interface to all microprocessors
- Operates ratiometrically or with 5 V_{DC} voltage reference
- No zero or full-scale adjust required
- 4-channel multiplexer with address logic
- Internal clock
- 0V to 5V input range with single 5V power supply
- T^2L/MOS input/output compatible
- 0.3" standard width 20-pin DIP

Block and Connection Diagrams





ADC0852, ADC0854 8-Bit Serial I/O D/A Converters with Comparator Output

General Description

The ADC0852 and ADC0854 are CMOS devices which combine a versatile analog input multiplexer, voltage comparator, and an 8-bit DAC which provides the comparator's threshold voltage (V_{TH}). The comparator provides a "1-bit" output as a result of a comparison between the analog input and the DAC's output. This allows for easy implementation of set-point, on-off or "bang-bang" control systems with several advantages over previous devices.

The ADC0854 has a 4 input multiplexer that can be software configured for single ended, pseudo-differential, and full-differential modes of operation. In addition the DAC's reference input is brought out to allow for reduction of the span.

The ADC0852 has a two input multiplexer that can be configured as 2 single-ended or 1 differential input pair. The DAC reference input is internally tied to V_{CC}.

The multiplexer and 8-bit DAC are programmed via a serial data input word. Once programmed the output is updated once each clock cycle up to a maximum clock rate of 400 KHz.

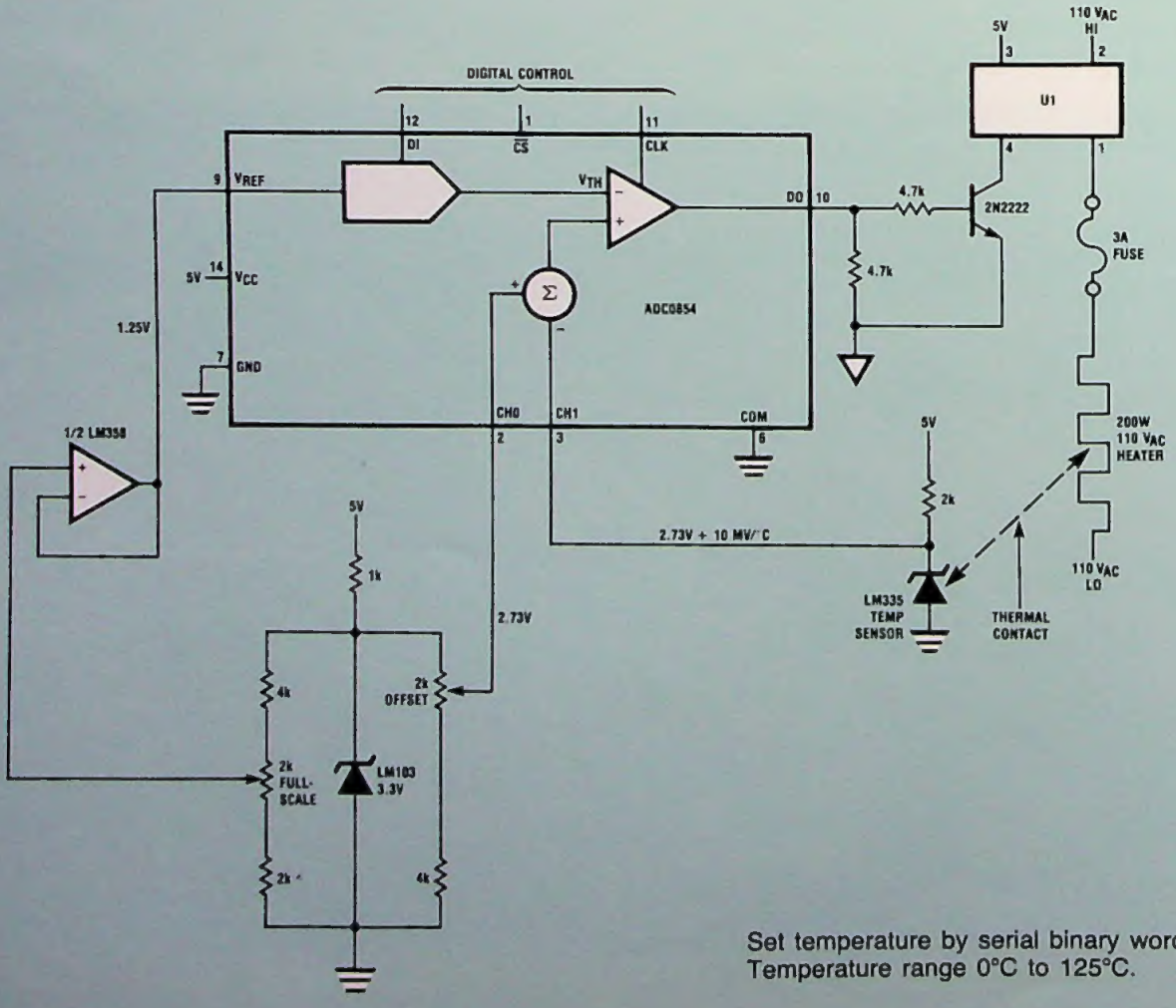
Key Specifications

- 6 μs comparator response time (250 KHz clock)
- Accuracy, ±½ LSB, or ±1 LSB of Reference (0.2%)
- Single 5V power supply
- Low Power—15 mW

Features

- 2 or 4 channel multiplexer
- Differential or Single-ended input, software controlled
- Serial digital data interface
- 256 programmable reference voltage levels
- Continuous comparison after programming
- Fixed, ratiometric, or reduced span reference capability

Typical Application



Set temperature by serial binary word into DI. Temperature range 0°C to 125°C.

ADC1005, ADC1025 10-Bit μP Compatible A/D Converters

General Description

The ADC1005 and ADC1025 are CMOS, 10-bit successive approximation A/D converters. The 20-pin ADC1005 outputs the 10-bit data result in two 8-bit bytes, formatted left justified with high-byte first. The six least significant bits of the second byte are set to zero.

The 24-pin ADC1025 outputs 10 bits in parallel for direct interface to a 16-bit data bus.

A differential analog voltage input allows increasing the common-mode rejection and offsetting the analog zero input voltage value. In addition, the voltage reference input can be adjusted to allow encoding a smaller analog voltage span to the full 10 bits of resolution.

Key Specifications

- Resolution—10 bits
- Total Unadjusted Error—±½ LSB and ±1 LSB
- Conversion Time—50 μs

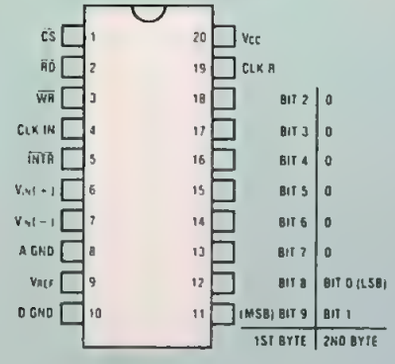
Features

- Compatible with 8080 μP derivatives—no interface logic needed
- Easy interface to all microprocessors
- Differential analog voltage inputs
- Operates ratiometrically or with 5 V_{DC} voltage reference or analog span adjusted voltage reference
- No zero or full-scale adjust required
- 0V to 5V analog input voltage range with single 5V supply
- On-chip clock generator
- T^2L/MOS input/output compatible
- 0.3" standard width 20-pin DIP or 0.6" 24-pin DIP with 10-bit parallel output

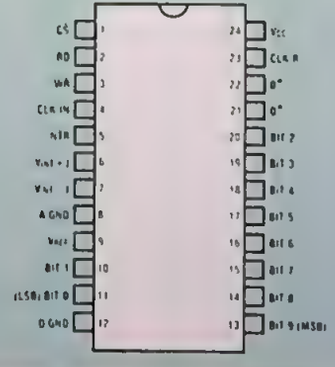
Connection Diagrams

(Top Views, Dual-In-Line Packages)

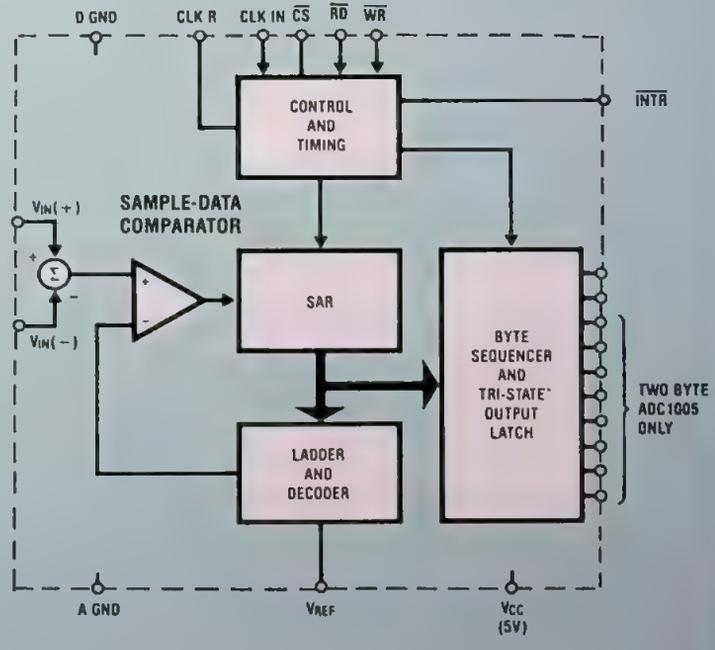
ADC1005 (for an 8-bit data bus)



ADC1025 (for all 16-bit outputs in parallel)



Functional Diagram



*TRI-STATE® output buffers which output 0 during RD.

ADC1205, ADC1225, 12-Bit Plus Sign μP Compatible A/D Converters

General Description

The ADC1205 and ADC1225 are CMOS, 12-bit plus sign successive approximation A/D converters. The 24-pin ADC1205 outputs the 13-bit data result in two 8-bit bytes formatted high-byte first with sign extended. The 28-pin ADC1225 outputs a 13-bit word in parallel for direct interface to a 16-bit data bus.

Negative numbers are represented in 2's compliment data format. All digital signals are fully T^2L compatible.

A unipolar input (0V to +5V) can be accommodated with a single +5V supply while a bipolar input (−5V to +5V) requires the addition of a negative supply.

The ADC1205B and ADC1225B have a maximum nonlinearity over temperature of 0.012% of FSR and the ADC1205C and ADC1225C have a maximum nonlinearity of 0.024% of FSR.

Key Specifications

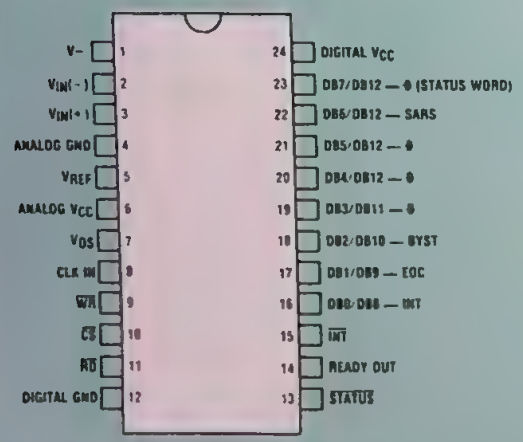
- Resolution—12 Bits plus sign
- Linearity Error—±½ LSB and ±1 LSB
- Conversion Time—100 μs

Features

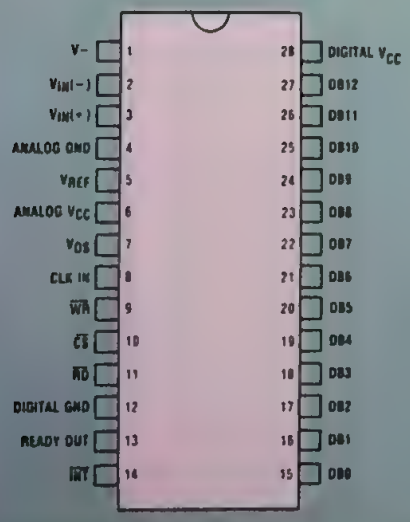
- Compatible with all μP's
- True differential analog voltage inputs
- 0V to 5V analog input voltage range with single 5V supply
- T^2L/MOS input/output compatible
- Low power—30 mW max

Connection Diagrams

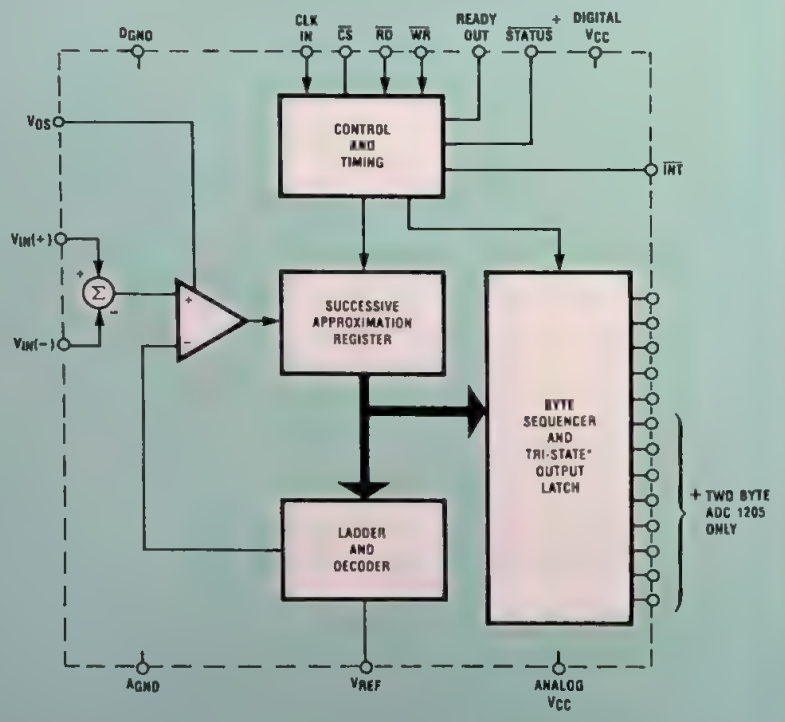
ADC1205



ADC 1225



Functional Diagram



D/A Converter Selection Guide

Part No.	Resolution (Bits)	Linearity @ 25°C % (Max)	Internal Reference	Output Op Amp	Settling Time (+½ LSB)	Supplies (V)	Temperature Range* M	I	C	Package	Comments
†ADC0852	8	0.19			4 μs	5		•	•	8-Pin DIP	DAC, Comparator, Serial Input
†ADC0854	8	0.39			4 μs	5		•	•	14-Pin DIP	DAC, Comparator, Serial Input
DAC0800	8	0.19			100 ns	±5 to ±15	•		•	16-Pin DIP	High-Speed Multiplying
DAC0801	8	0.39			100 ns	±5 to ±15	•		•	16-Pin DIP	High-Speed Multiplying
DAC0806	8	0.78			150 ns	±5 to ±15			•	16-Pin DIP	Multiplying
DAC0807	8	0.39			150 ns	±5 to ±15			•	16-Pin DIP	Multiplying
DAC0808	8	0.19			150 ns	±5 to ±15	•		•	16-Pin DIP	Multiplying
DAC0830	8	0.05			1 μs	5 to 15	•	•	•	20-Pin DIP	μP Compatible 4-Quadrant Multiplying
DAC0831	8	0.10			1 μs	5 to 15		•	•	20-Pin DIP	μP Compatible 4-Quadrant Multiplying
DAC0832	8	0.20			1 μs	5 to 15		•	•	20-Pin DIP	μP Compatible 4-Quadrant Multiplying
DAC1000	10	0.05			500 ns	5 to 15	•	•	•	24-Pin DIP	μP Compatible Double Buffered
DAC1001	10	0.1			500 ns	5 to 15		•	•	24-Pin DIP	μP Compatible Double Buffered
DAC1002	10	0.2			500 ns	5 to 15		•	•	24-Pin DIP	μP Compatible Double Buffered
DAC1006	10	0.05			500 ns	5 to 15	•	•	•	20-Pin DIP	μP Compatible Double Buffered
DAC1007	10	0.1			500 ns	5 to 15		•	•	20-Pin DIP	μP Compatible Double Buffered
DAC1008	10	0.2			500 ns	5 to 15		•	•	20-Pin DIP	μP Compatible Double Buffered
DAC1020	10	0.05			500 ns	5 to 15	•	•	•	16-Pin DIP	4-Quadrant Multiplying
DAC1021	10	0.1			500 ns	5 to 15	•	•	•	16-Pin DIP	4-Quadrant Multiplying
DAC1022	10	0.2			500 ns	5 to 15	•	•	•	16-Pin DIP	4-Quadrant Multiplying
DAC1208	12	0.012			1 μs	5 to 15		•	•	24-Pin DIP	μP Compatible 4-Quadrant Multiplying
DAC1209	12	0.024			1 μs	5 to 15		•	•	24-Pin DIP	μP Compatible 4-Quadrant Multiplying
DAC1210	12	0.05			1 μs	5 to 15		•	•	24-Pin DIP	μP Compatible 4-Quadrant Multiplying
DAC1218	12	0.012			1 μs	5 to 15		•	•	18-Pin DIP	4-Quadrant Multiplying

*Ambient temperature range for "M" is −55°C to +125°C, "I" is −25°C to +85°C or −40°C to +85°C, "C" 0°C to 70°C.

D/A Converter Selection Guide (continued)

Part No.	Resolution (Bits)	Linearity @ 25°C % (Max)	Internal Reference	Output Op Amp	Settling Time (+ ½ LSB)	Supplies (V)	Temperature Range* M	I	C	Package	Comments
DAC1219	12	0.024			1 μs	5 to 15			•	18-Pin DIP	4-Quadrant Multiplying
DAC1220	12	0.05			500 ns	5 to 15	•	•	•	18-Pin DIP	4-Quadrant Multiplying
DAC1221	12	0.1			500 ns	5 to 15	•	•	•	18-Pin DIP	4-Quadrant Multiplying
DAC1222	12	0.2			500 ns	5 to 15	•	•	•	18-Pin DIP	4-Quadrant Multiplying
DAC1230	12	0.012			1 μs	5 to 15	•	•	•	20-Pin DIP	μP Compatible 4-Quadrant Multiplying
DAC1231	12	0.024			1 μs	5 to 15		•	•	20-Pin DIP	μP Compatible 4-Quadrant Multiplying
DAC1232	12	0.05			1 μs	5 to 15		•	•	20-Pin DIP	μP Compatible 4-Quadrant Multiplying
†DAC1265A	12	0.006	•		200 ns	±15	•		•	24-Pin DIP	High-Speed
†DAC1265	12	0.012	•		200 ns	±15	•		•	24-Pin DIP	High-Speed
†DAC1266A	12	0.006			200 ns	±12 to ±15	•		•	24-Pin DIP	High-Speed
†DAC1266	12	0.012			200 ns	±12 to ±15	•		•	24-Pin DIP	High-Speed

*Ambient temperature range for "M" is −55°C to +125°C, "I" is −25°C to +85°C or −40°C to +85°C, "C" is 0°C to 70°C.
†Product to be announced.

Micro-DAC™ DAC0830, DAC0831, DAC0832, DAC1006, DAC1007, DAC1008, DAC1230, DAC1231, DAC1232 8-, 10-, and 12-Bit Microprocessor Compatible Double-Buffered Digital-to-Analog Converters

General Description

These D to A converters are advanced CMOS/Si-Cr 8-bit multiplying DAC designed to interface directly with the 8080, 8048, 8085, Z-80, and other popular microprocessors. A deposited silicon-chromium R-2R resistor ladder network divides the reference current and provides the circuit with excellent temperature tracking characteristics. The circuit uses CMOS current switches and control logic to achieve low power consumption and low output leakage current errors. Special circuitry provides TTL logic input voltage level compatibility.

Double buffering allows these DACs to output a voltage corresponding to one digital word while holding the next digital word. This permits the simultaneous updating of any number of DACs.

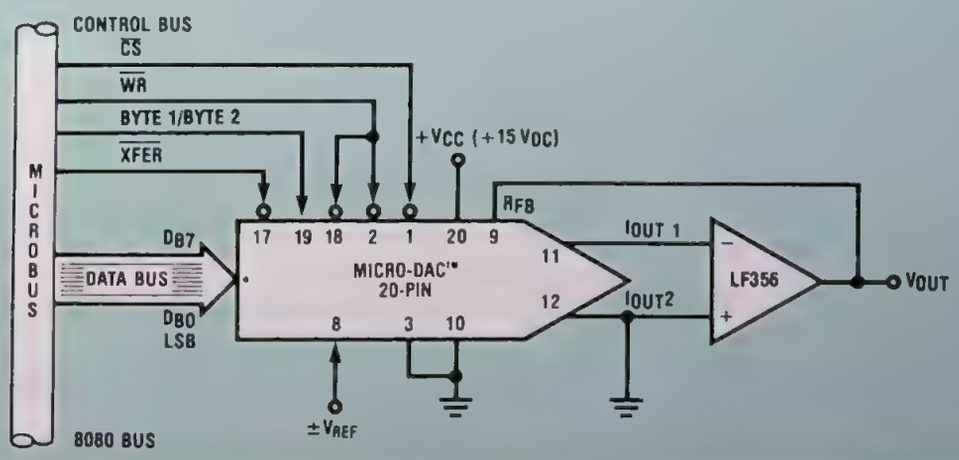
Features

- Linearity specified with full scale adjust only
- Direct interface to all popular microprocessors
- Double-buffered, single-buffered or flow-through digital data inputs
- Loads in one 8-bit word
- Logic inputs which meet TTL voltage level specs (1.4V logic threshold)
- Works with ±10V reference-full 4-quadrant multiplication
- Operates "STAND ALONE" (without μP) if desired
- 0.3" standard 20-pin package

Key Specifications

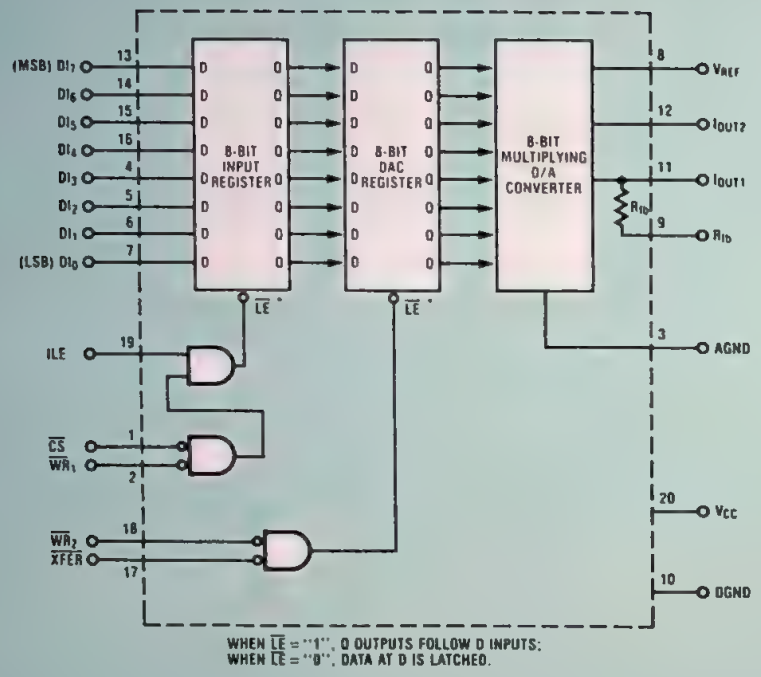
- Current Settling Time—1 μs
- Resolution—8, 10, or 12 Bits
- Linearity—8, 9, 10, 11, or 12 Bits (guaranteed over temp.)
- Gain Tempco—0.0002% FS/°C
- Low Power Dissipation—20 mW
- Single Power Supply—5 to 15 V_{DC}
- Low Cost

Typical Application

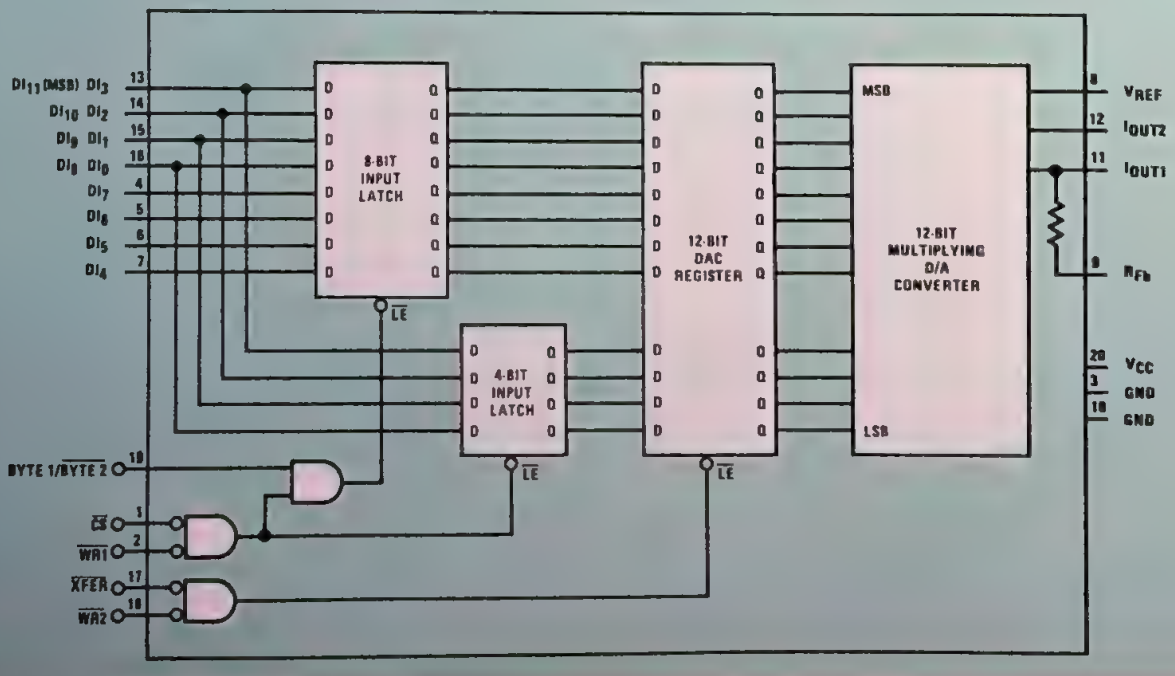


Micro-DAC™ DAC0830, DAC0831, DAC0832, DAC1006, DAC1007, DAC1008, DAC1230, DAC1231, DAC1232
8-, 10-, and 12-Bit Microprocessor Compatible Double-Buffered Digital-to-Analog Converters

Block Diagram
DAC0830, DAC0831, DAC0832



Block Diagram
DAC1230, DAC1231, DAC1232



DAC1265A, DAC1265 High-Speed 12-Bit D/A Converter with Reference

General Description

The DAC1265A and DAC1265 are fast 12-bit digital to analog converters with internal voltage reference. These DACs use 12 precision high-speed bipolar current steering switches, control amplifier, thin film resistor network, and buried zener voltage reference to obtain a high accuracy, very fast analog output current. The DAC1265A and DAC1265 have 10%-90% full-scale transition time under 35 ns and settle to less than ½ LSB in 200 ns. The buried zener reference has long-term stability and temperature drift characteristics comparable to the best discrete or separate IC references.

These digital to analog converters are recommended for applications in CRT displays, precision instruments and data acquisition systems requiring throughput rates as high as 5 MHz for full range transitions.

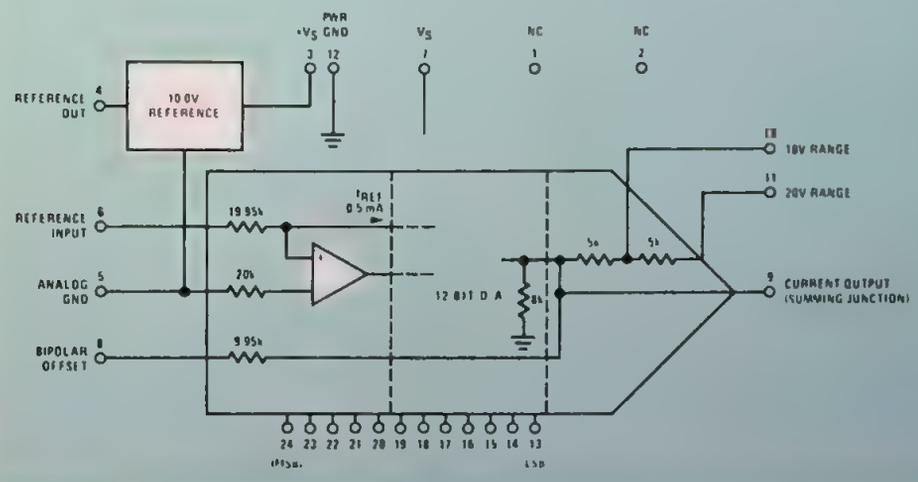
Key Specifications

- Resolution and Monotonicity—12 Bits
- Linearity—12 Bits (Guaranteed over Temperature)
- Output Current Settling Time—400ns max to 0.01%
- Gain Tempco—±15 ppm/°C max
- Power Supply Sensitivity—±10 ppm of FS/% V_{SUPPLY}

Features

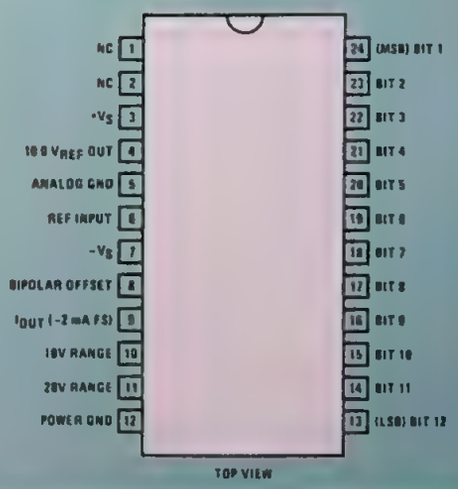
- Bipolar current output DAC and voltage reference
- Fully differential, nonsaturating precision current switch—R_{OUT} and C_{OUT} do not change with digital input code
- Internal buried zener reference—10V ± 1% max
- Precision thin film resistors for use with external op amp for voltage out or as input resistors for a successive approximation A/D converter
- Superior replacement for 12-bit D/A converters of this type

Block Diagram



Connection Diagram

Dual-In-Line Package



Instrumentation Amplifier Selection Guide

	LH0036	LH0036C	LH0037	LH0037C	LH0038	LH0038C	LM163A/363A	LM163	LM363
Gain									
Range	1-2000	1-2000	1-2000	1-2000	100-2000	100-2000	10-1000	10-1000	10-1000
Error (G = 100 max %)	1	3	1	3	.3	.4	.2	.3	.5
Overall Input Offset Voltage (G = 100, mV max) $V_{OS} = (\Delta V_{CL})\ (V_{IOS}) + V_{OOS}$	105	210	105	210	20	40	.15	.3	.5
I_{BIAS}, nA Max	100	125	500	500	100	100	5	5	10
I_{OS}, nA Max	40	50	100	250	5	10	1	2	3
Noise, RTI, 0.1 Hz-10 Hz, μV_{PP}									
G = 100	20	20	15	15	.2	.2	1.5	1.5	1.5
G = 1000	20	20	15	15	.2	.2	.4	.4	.4
CMR at Rated CMV (db max)									
G = 1	52	46	52	46					
G = 10	72	66	72	60			100	94	90
G = 100	80	80	80	80	94	86	112	106	94
G = 1000					114	106	125	120	114
Settling Time to 0.1% ±10V Output Step G = 100 (μs)	180	180	180	180	70	70	25	25	25
Temperature Range*	M	I	M	I	M	I	M, C	M	C

*Temperature ranges are: "M" is −55°C to +125°C ambient, "I" is −25°C to +85°C, "C" is 0°C to 70°C.

LM163/LM363 Precision Instrumentation Amplifier

General Description

The LM163 is a monolithic true instrumentation amplifier. It requires no external parts for fixed gains of 10, 100 and 1,000. High precision is attained by on-chip trimming of offset voltage and gain. A super beta bipolar input stage gives very low input voltage noise, extremely low offset voltage drift, and high common-mode rejection ratio. A new two-stage amplifier design yields an open loop gain of 10,000,000 and a gain bandwidth product of 30 MHz, yet remains stable for all closed loop gains, even with large capacitive loads. Supply voltage range is ±5V to ±18V.

The LM163 has separate force, sense, and reference pins to allow gain to be increased using external resistors. Twin differential shield drivers eliminate bandwidth loss due to shield capacitance. Compensation pins are available to allow simple low-pass filtering. The LM163 with all options is in a 16-pin dual-in-line package.

For less stringent applications requiring a single fixed gain, it is also available in an 8-pin TO-5 package. Shield drivers, pin-strapped gain options, and offset adjustment pins are eliminated on the 8-pin versions. Gain is internally set at 10, 100, or 500, but may be increased with the addition of external resistors.

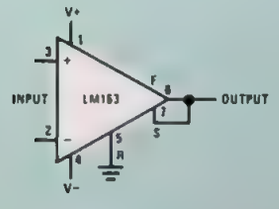
The LM163 is rated for −55°C to +125°C operation. The LM363 is rated for 0°C to 70°C operation.

Features

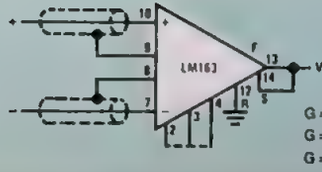
- Offset and gain pretrimmed
- 7 nV/√Hz input noise
- 130 dB CMRR typical
- 2 nA bias current typical
- No external parts required
- Differential shield drivers
- Available at 0.5 μV/°C maximum drift
- Can be used as a high performance op-amp

Typical Connections

8-Pin Package

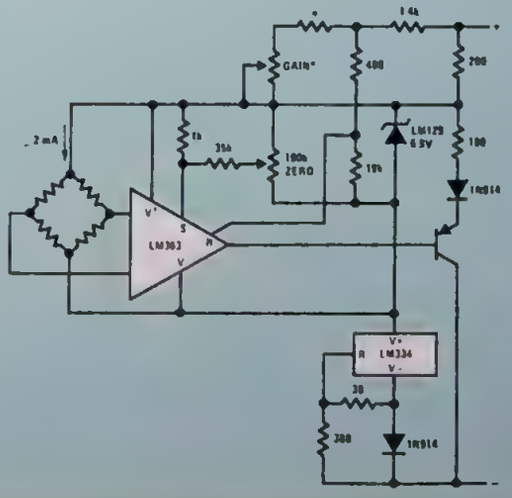


16-Pin Package



Typical Application

4-20 mA Transmitter



LF13006, LF13007 Digital Programmable Gain Set

General Description

The LF13006, LF13007 are precision digitally programmable resistive gain network sets used for accurately setting noninverting op amp gains. Gain is set with a 3-bit digital word which can be latched in with $\overline{WR}$ and $\overline{CS}$ pins. All digital inputs are TTL and CMOS compatible.

The LF13006 shown below will set binary scaled gains of 1, 2, 4, 8, 16, 32, 64, and 128. The LF13007 will set gains of 1, 2, 5, 10, 20, 50, and 100. In addition, both versions have several taps and two uncommitted matching resistors which allow customization of the gain.

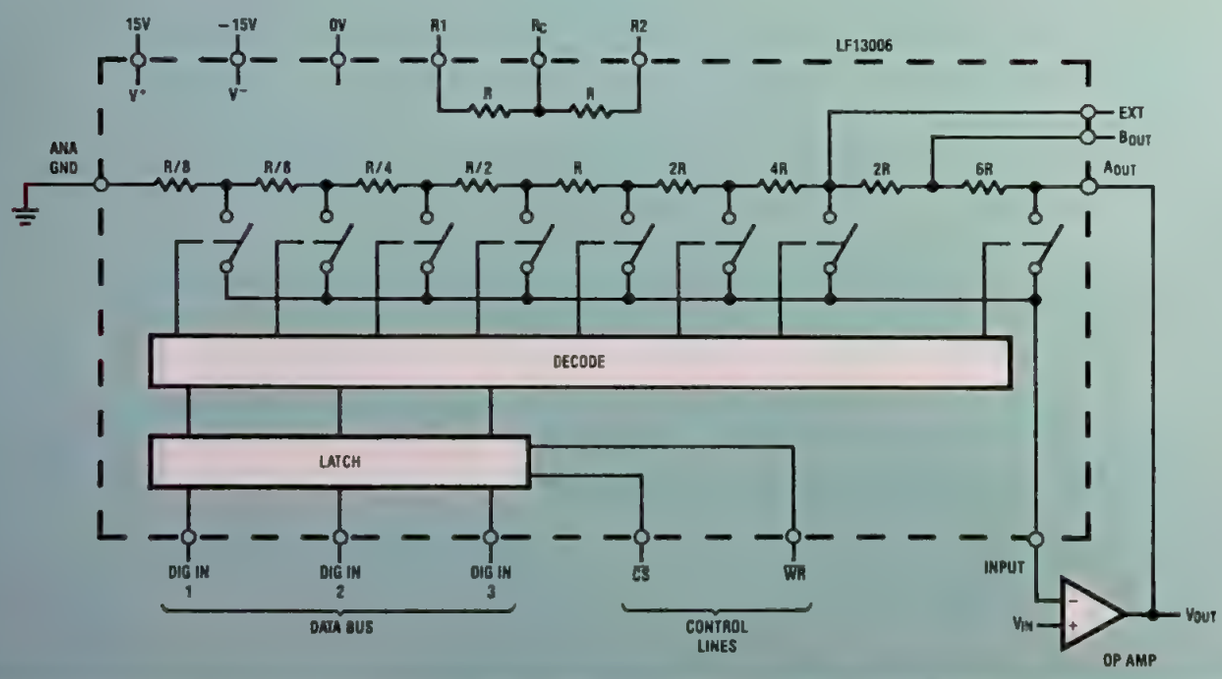
The gains are set with precision thin film resistors. The low temperature coefficient of the thin film resistors and their excellent tracking result in gain ratios which are virtually independent of temperature.

The LF13006, LF13007 used in conjunction with an amplifier not only satisfies the need for a digitally programmable amplifier in microprocessor based systems, but is also useful for discrete applications, eliminating the need to find 0.5% resistors with a ratio of 100 to 1 which track each other over temperature.

Features

- TTL and CMOS compatible logic levels
- Microprocessor compatible
- Gain accuracy .5% max
- Binary or scope-knob scaled
- Supply voltage +5V to ±18V
- Packaged in 16-pin DIP

Block Diagram and Typical Application (LF13006)



Analog Switches/Multiplexers Selection Guide

R_{ON} (Ω)*	V_A/I (V)†	Part Number	Logic Input	V_S (V) Typ	t_{ON}/t_{OFF} Typ
QUAD SPST					
100	15 mA	AH5011	15V TTL, CMOS		150/300 ns
150	5 mA	AH5012	TTL, CMOS		150/300 ns
200	±10	LF11201	TTL	±15	90/500 ns
200	±10	LF11202	TTL	±15	90/500 ns
200	±10	LF11331	TTL	±15	90/500 ns
200	±10	LF11332	TTL	±15	90/500 ns
200	±10	LF11333	TTL	±15	90/500 ns
250	±10	LF13201	TTL	±15	90/500 ns
250	±10	LF13202	TTL	±15	90/500 ns
250	±10	LF13331	TTL	±15	90/500 ns
250	±10	LF13332	TTL	±15	90/500 ns
250	±10	LF13333	TTL	±15	90/500 ns
280	±7.5	CD4066	CMOS	±7.5	50/50 ns
850	±7.5	CD4016	CMOS	±7.5	20/20 ns
TRIPLE SPDT					
280	±7.5	CD4053	CMOS	±7.5	150/150 ns
DUAL SPDT					
150	5 mA	AH5020	TTL, CMOS		150/300 ns
4-CHANNEL					
100	15 mA	AH5009	15V TTL, CMOS		150/300 ns
150	5 mA	AH5010	TTL, CMOS		150/300 ns
4-CHANNEL DIFFERENTIAL					
280	±7.5	CD4052	CMOS	±7.5	150/150 ns
350	12, −15	LF11509	TTL	±15	1/0.2 μs
270	±7.5	CD4529B	CMOS	±7.5	50/50 ns
8-CHANNEL					
250-400	±5	AM3705	TTL	−15, 5	300/600 ns
350	12, −15	LF11508	TTL	±15	1/0.2 μs
270	±7.5	CD4529B	CMOS	±7.5	50/50 ns
280	±7.5	CD4501	CMOS	±7.5	150/150 ns

*R_{ON} max @ T_A = 25°C

†V_A/I = maximum voltage or current to be safely switched

Voltage Reference Selection Guide

Reverse Breakdown Voltage V_R at I_R	Device	Voltage Tolerance Max, T_A = 25°C	Voltage Temperature Drift-ppm/°C Max or mV Max Change Over Temperature Range: Drift (Max)	Temperature Range	Current Range, I_R	Dynamic Output Impedance (Max)
1.22	LM113	±5%	100 ppm typ	−55°C to +125°C	500 μA to 20 mA	0.8Ω
1.22	LM313	±5%	100 ppm typ	0°C to +70°C	500 μA to 20 mA	0.8Ω
1.22	LM113-1	±1%	50 ppm typ	−55°C to +125°C	500 μA to 20 mA	0.8Ω
1.22	LM113-2	±2%	50 ppm typ	−55°C to +125°C	500 μA to 20 mA	0.8Ω
1.23	LM185-1.2	±1%	150 ppm	−55°C to +125°C	1 mA to 20 mA	0.6Ω
1.23	LM185BY-1.2	±1%	50 ppm	−55°C to +125°C	1 mA to 20 mA	0.6Ω
1.23	LM185BX-1.2	±1%	30 ppm	−55°C to +125°C	1 mA to 20 mA	0.6Ω
1.23	LM285-1.2	±1%	150 ppm	−40°C to +85°C	1 mA to 20 mA	0.6Ω
1.23	LM285BX-1.2	±1%	30 ppm	−40°C to +85°C	1 mA to 20 mA	0.6Ω
1.23	LM285BY-1.2	±1%	50 ppm	−40°C to +85°C	1 mA to 20 mA	0.6Ω
1.23	LM385-1.2	−2.5, +2	150 ppm	0°C to +70°C	1 mA to 20 mA	1Ω
1.23	LM385BX-1.2	±1%	30 ppm	0°C to +70°C	1 mA to 20 mA	1Ω
1.23	LM385BY-1.2	±1%	50 ppm	0°C to +70°C	1 mA to 20 mA	1Ω
1.24	LM185B	±1.5%	150 ppm	−55°C to +125°C	10 μA to 20 mA	0.3Ω
1.24	LM185BX	±1.5%	30 ppm	−55°C to +125°C	10 μA to 20 mA	0.3Ω
1.24	LM185BY	±1.5%	50 ppm	−55°C to +125°C	10 μA to 20 mA	0.3Ω
1.24	LM285	±1.5%	150 ppm	−40°C to +85°C	10 μA to 20 mA	0.3Ω
1.24	LM285BX	±1.5%	30 ppm	−40°C to +85°C	10 μA to 20 mA	0.3Ω
1.24	LM285BY	±1.5%	50 ppm	−40°C to +85°C	10 μA to 20 mA	0.3Ω
1.24	LM385	±3%	150 ppm	0°C to 70°C	10 μA to 20 mA	0.4Ω
1.24	LM385BX	±1.5%	30 ppm	0°C to 70°C	10 μA to 20 mA	0.4Ω
1.24	LM385BY	±1.5%	50 ppm	0°C to 70°C	10 μA to 20 mA	0.4Ω
2.49	LM136	±2%	18 mV	−55°C to +125°C	400 μA to 10 mA	0.6Ω
2.49	LM136A	±1%	18 mV	−55°C to +125°C	400 μA to 10 mA	0.6Ω
2.49	LM236	±2%	9 mV	−25°C to +85°C	400 μA to 10 mA	0.6Ω
2.49	LM236A	±1%	9 mV	−25°C to +85°C	400 μA to 10 mA	0.6Ω
2.49	LM336	±4%	6 mV	0°C to +70°C	400 μA to 10 mA	1Ω
2.49	LM336B	±2%	6 mV	0°C to +70°C	400 μA to 10 mA	1Ω
2.5	LM185-2.5	±1.5%	150 ppm	−55°C to +125°C	20 μA to 20 mA	0.6Ω
2.5	LM185BY-2.5	±1.5%	50 ppm	−55°C to +125°C	20 μA to 20 mA	0.6Ω
2.5	LM185BX-2.5	±1.5%	30 ppm	−55°C to +125°C	20 μA to 20 mA	0.6Ω
2.5	LM285-2.5	±1.5%	150 ppm	−40°C to +85°C	20 μA to 20 mA	0.6Ω
2.5	LM285BX-2.5	±1.5%	30 ppm	−40°C to +85°C	20 μA to 20 mA	0.6Ω
2.5	LM285BY-2.5	±1.5%	50 ppm	−40°C to +85°C	20 μA to 20 mA	0.6Ω
2.5	LM385-2.5	±3%	150 ppm	0°C to +70°C	20 μA to 20 mA	1Ω
2.5	LM385BX-2.5	±1.5%	30 ppm	0°C to +70°C	20 μA to 20 mA	1Ω
2.5	LM385BY-2.5	±1.5%	50 ppm	0°C to +70°C	20 μA to 20 mA	1Ω
5.0	LM136-5.0	±2%	36 mV	−55°C to +125°C	400 μA to 10 mA	0.6Ω
5.0	LM136A-5.0	±1%	36 mV	−55°C to +125°C	400 μA to 10 mA	0.6Ω
5.0	LM168BY-5.0	±0.05%	±10 ppm	−55°C to +125°C	0 mA to 10 mA	0.05Ω
5.0	LM236-5.0	±2%	18 mV	−25°C to +85°C	400 μA to 10 mA	0.6Ω
5.0	LM236A-5.0	±1%	18 mV	−25°C to +85°C	400 μA to 10 mA	0.6Ω
5.0	LM336-5.0	±4%	12 mV	0°C to +70°C	400 μA to 10 mA	1Ω
5.0	LM336B-5.0	±2%	12 mV	0°C to +70°C	400 μA to 10 mA	1Ω
5.0	LM268BY-5.0	±0.05%	±15 ppm	−40°C to +85°C	0 mA to 10 mA	0.05Ω
5.0	LM368-5.0	±0.1%	±30 ppm	0°C to +70°C	0 mA to 10 mA	0.05Ω
5.0	LM368Y-5.0	±0.05%	±20 ppm	0°C to +70°C	0 mA to 10 mA	0.05Ω
6.2	LM168BY-6.2	±0.5%	±10 ppm	−55°C to +125°C	0 mA to 10 mA	0.05Ω
6.2	LM268BY-6.2	±0.05%	±15 ppm	−40°C to +85°C	0 mA to 10 mA	0.05Ω
6.2	LM368-6.2	±0.1%	±30 ppm	0°C to +70°C	0 mA to 10 mA	0.05Ω
6.2	LM368Y-6.2	±0.05%	±20 ppm	0°C to +70°C	0 mA to 10 mA	0.05Ω
6.90	LM129A	+3%, −2%	10 ppm	−55°C to +125°C	0.6 mA to 15 mA	1Ω
6.90	LM129B	+3%, −2%	20 ppm	−55°C to +125°C	0.6 mA to 15 mA	1Ω
6.90	LM129C	+3%, −2%	50 ppm	−55°C to +85°C	0.6 mA to 15 mA	1Ω
6.90	LM329B	±5%	20 ppm	0°C to +70°C	0.6 mA to 15 mA	2Ω
6.90	LM329C	±5%	50 ppm	0°C to +70°C	0.6 mA to 15 mA	2Ω
6.90	LM329D	±5%	100 ppm	0°C to +70°C	0.6 mA to 15 mA	2Ω
6.95	LM199A	+1%, −2%	0.5 ppm	−55°C to +85°C	0.5 mA to 10 mA	1Ω
6.95	LM199A	+1%, −2%	10 ppm	85°C to +125°C	0.5 mA to 10 mA	1Ω
6.95	LM199	+1%, −2%	1 ppm	−55°C to +85°C	0.5 mA to 10 mA	1Ω
6.95	LM199	+1%, −2%	15 ppm	85°C to +125°C	0.5 mA to 10 mA	1Ω
6.95	LM299A	+1%, −2%	0.5 ppm	−25°C to +85°C	0.5 mA to 10 mA	1Ω

Voltage Reference Selection Guide (continued)

Reverse Breakdown Voltage V_R at I_R	Device	Voltage Tolerance Max, T_A = 25°C	Voltage Temperature Drift-ppm/°C Max or mV Max Change Over Temperature Range: Drift (Max)	Temperature Range	Current Range, I_R	Dynamic Output Impedance (Max)
6.95	LM299	+1%, −2%	1 ppm	−25°C to +85°C	0.5 mA to 10 mA	1Ω
6.95	LM399A	±5%	1 ppm	0°C to +70°C	0.5 mA to 10 mA	1.5Ω
6.95	LM399	±5%	2 ppm	0°C to +70°C	0.5 mA to 10 mA	1.5Ω
6.95	LM3999	±5%	5 ppm	0°C to +70°C	0.6 mA to 10 mA	2.2Ω
10.00	LH0070-0	0.1%	20 mV	−25°C to +85°C	0 mA to 20 mA	1Ω
10.00	LH0070-1	0.1%	10 mV	−25°C to +85°C	0 mA to 20 mA	1Ω
10.00	LH0070-2	0.05%	4 mV	−25°C to +85°C	0 mA to 20 mA	1Ω
10.0	LM168BY-10	±0.05%	±10 ppm	−55°C to +125°C	0 mA to 10 mA	0.1Ω
10.0	LM268BY-10	±0.05%	±15 ppm	−40°C to +85°C	0 mA to 10 mA	0.1Ω
10.0	LM368-10	±0.1%	±30 ppm	0°C to 70°C	0 mA to 10 mA	0.1Ω
10.0	LM368A-10	±0.05%	±20 ppm	0°C to 70°C	0 mA to 10 mA	0.1Ω
10.24	LH0071-0	0.1%	20 mV	−25°C to +85°C	0 mA to 20 mA	1Ω
10.24	LH0071-1	0.1%	10 mV	−25°C to +85°C	0 mA to 20 mA	1Ω
10.24	LH0071-2	0.05%	4 mV	−25°C to +85°C	0 mA to 20 mA	1Ω
Adjustable— 5V, 6V, 10, 12V, 15V	LH0075	±0.5%	0.003%/°C typ	−55°C to +125°C	1 mA to 200 mA	1Ω
Adjustable— 5V, 6V, 10V, 12V, 15V	LH0075C	±1%	0.003%/°C typ	0°C to +70°C	1 mA to 200 mA	1Ω
Adjustable—−5V, −6V, −10V, −12V, −15V	LH0076	±0.5%	0.003%/°C typ	−55°C to +125°C	1 mA to 200 mA	1Ω
Adjustable—−5V, −6V, −10V, −12V, −15V	LH0076C	±1%	0.003%/°C typ	0°C to +70°C	1 mA to 200 mA	1Ω
Adjustable— 1.24V to 5.3V	†LM185ADJ	1%	0.002%/°C typ*	−55°C to +125°C	10 μA to 20 mA	1Ω
1.24V to 5.3V	†LM285ADJ	1%	0.002%/°C typ*	−25°C to +85°C	10 μA to 20 mA	1Ω
1.24V to 5.3V	†LM385ADJ	2%	0.002%/°C typ*	0°C to +70°C	10 μA to 20 mA	1Ω
LOW CURRENT ZENER DIODES						
1.8	LM103	±10%	−5 mV/°C typ	−55°C to +125°C	10 μA to 10 mA	25Ω
2.0	LM103	±10%	−5 mV/°C typ	−55°C to +125°C	10 μA to 10 mA	25Ω
2.2	LM103	±10%	−5 mV/°C typ	−55°C to +125°C	10 μA to 10 mA	25Ω
2.4	LM103	±10%	−5 mV/°C typ	−55°C to +125°C	10 μA to 10 mA	25Ω
2.7	LM103	±10%	−5 mV/°C typ	−55°C to +125°C	10 μA to 10 mA	25Ω
3.0	LM103	±10%	−5 mV/°C typ	−55°C to +125°C	10 μA to 10 mA	25Ω
3.3	LM103	±10%	−5 mV/°C typ	−55°C to +125°C	10 μA to 10 mA	25Ω
3.6	LM103	±10%	−5 mV/°C typ	−55°C to +125°C	10 μA to 10 mA	25Ω
3.9	LM103	±10%	−5 mV/°C typ	−55°C to +125°C	10 μA to 10 mA	25Ω
4.3	LM103	±10%	−5 mV/°C typ	−55°C to +125°C	10 μA to 10 mA	25Ω
4.7	LM103	±10%	−5 mV/°C typ	−55°C to +125°C	10 μA to 10 mA	25Ω
5.1	LM103	±10%	−5 mV/°C typ	−55°C to +125°C	10 μA to 10 mA	25Ω
5.6	LM103	±10%	−5 mV/°C typ	−55°C to +125°C	10 μA to 10 mA	25Ω

†To Be Announced

LM368A, LM368 Precision, Low Temperature Coefficient Voltage Reference

General Description

The LM368A and LM368 are temperature-compensated band gap voltage references for precision data converter applications.

These monolithic references make use of wafer laser trimmed technology to achieve initial accuracy of 0.02% as well as high temperature stability.

Typical applications are 8- to 12-bit A/D and D/A converter references as well as replacing low temperature coefficient zeners.

The LM368A and LM368 output voltage options are 5.0V, 6.2V, and 10.0V.

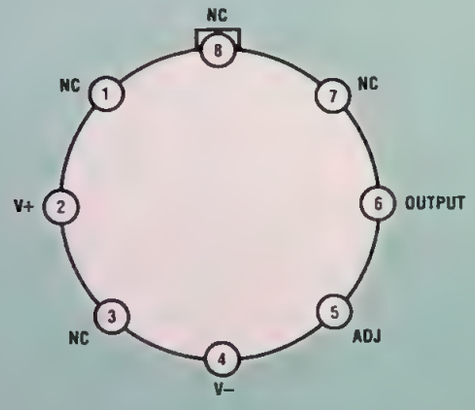
The devices operate in both series or shunt mode. The devices are short circuit proof when sourcing current.

Features

- Output voltage 5.0, 6.2, 10.0, or 10.24 volts
- Maximum output tolerance of LM368A ±.05%; LM368 ±.1%
- Temperature coefficient maximum, ±10 ppm/°C, ±15 ppm/°C or ±20 ppm/°C
- Quiescent current—250μA typical
- Output impedance—0.05Ω
- Line regulation—.0001%/V typical
- Operates in series or shunt mode
- Single supply

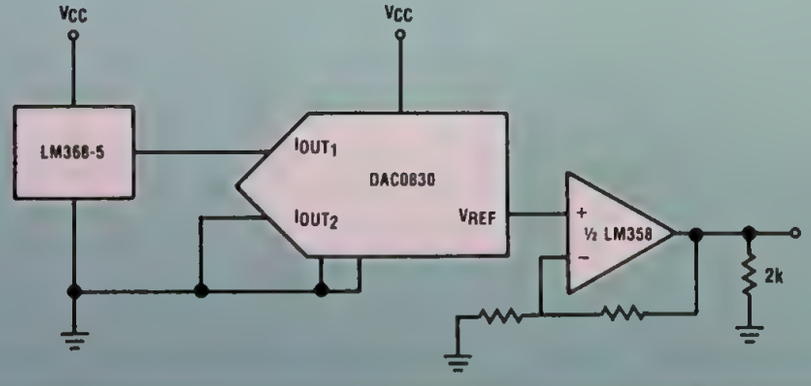
Connection Diagram

TO-99
Metal Can Package



Typical Application

Single Supply D/A Converter



LM185-2.5, LM285-2.5, LM385-2.5
Micropower Voltage Reference Diode

General Description

The LM185-2.5, LM285-2.5 are micropower 2-terminal band-gap voltage regulator diodes. Operating over a 20 μA to 20 mA current range, they feature exceptionally low dynamic impedance and good temperature stability. On-chip trimming is used to provide tight voltage tolerance. Since the LM185-2.5 band-gap reference uses only transistors and resistors, low noise and good long term stability result.

Careful design of the LM185-2.5 has made the device exceptionally tolerant of capacitive loading, making it easy to use in almost any reference application. The wide dynamic operating range allows its use with widely varying supplies with excellent regulation.

The extremely low power drain of the LM185-2.5 makes it useful for micropower circuitry. This voltage reference can be used to make portable meters, regulators or general purpose analog circuitry with battery life approaching shelf life.

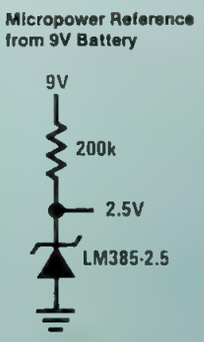
The LM185-2.5 is rated for operation over a −55°C to 125°C temperature range while the LM285-2.5 is rated −25°C to 85°C and the LM385-2.5 0°C to 70°C. The LM185-2.5, LM285-2.5, LM385-2.5 are available in a hermetic TO-46 package and the LM385-2.5 is also available in a low-cost TO-92 molded package.

Features

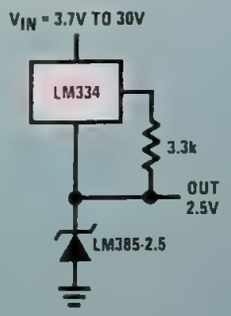
- Operating current of 20 μA to 20 mA
- 1.5% and 3% initial tolerance
- 1Ω dynamic impedance
- Guaranteed low temperature coefficient—30 ppm/°C, 50 ppm/°C
- Low voltage reference—2.5V

Applications

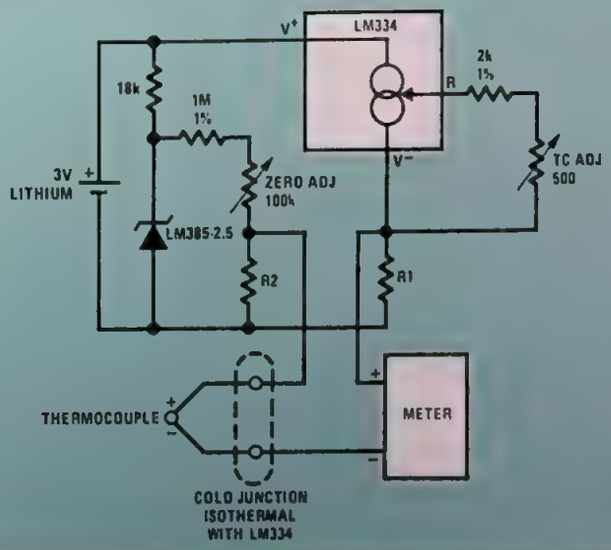
Adjustment Procedure



Wide Input Range Reference



Micropower Thermocouple Cold Junction Compensator



Sample and Hold Selection Guide

	LF198A	LF398A	LF198	LF398	LH0023	LH0023C	LH0043	LH0043C
Accuracy (% Max) Gain/Offset Error	0.01	0.01	0.02	0.02	0.01	0.02	0.1	0.3
Offset Voltage (mV Max)	2	3	5	10	20	20	40	40
Droop Rate (mV/sec, 25°C)								
C_H = 1000pF	30	30	30	30	100	100	10	10
C_H = 10000pF	3	3	3	3	10	10	1	1
Acquisition Time (μsec, 25°C)								
C_H = 1000pF	4	4	4	4	10	10	10	10
C_H = 10000pF	20	20	20	20	50	50	50	50
Aperture Time (nsec, 25°C)	25	25	25	25	150	150	20	20
Temperature Range (°C)	−55 to +125	0 to +70	−55 to +125	0 to +70	−55 to +125	−25 to +85	−55 to +125	−25 to +85
Comment	Low Drift	Low Drift	General Purpose	General Purpose	Low Drift	Low Drift	Medium Speed	Medium Speed

LF198, LF298, LF398 Sample and Hold Circuits

General Description

The LF198, LF298, LF398 are monolithic sample and hold circuits which utilize BI-FET technology to obtain ultra-high dc accuracy with fast acquisition of signal and low droop rate. Operating as a unity gain follower, dc gain accuracy is 0.002% typical and acquisition time is as low as 4μs to 0.01%. A bipolar input stage is used to achieve low offset voltage and wide bandwidth. Input offset adjust is accomplished with a single pin and does not degrade input offset drift. The wide bandwidth allows the LF198 to be included inside the feedback loop of 1 MHz op amps without having stability problems. Input impedance of $10^{10}\Omega$ allows high source impedances to be used without degrading accuracy.

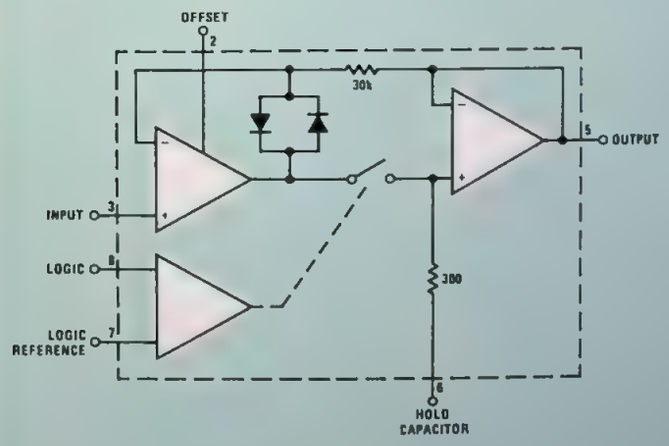
P-channel junction FETs are combined with bipolar devices in the output amplifier to give droop rates as low as 5 mV/min with a 1 μF hold capacitor. The JFETs have much lower noise than MOS devices used in previous designs and do not exhibit high temperature instabilities. The overall design guarantees no feedthrough from input to output in the hold mode even for input signals equal to the supply voltages.

Logic inputs on the LF198 are fully differential with low input current, allowing direct connection to TTL, PMOS, and CMOS control devices. Differential threshold is 1.4V. The LF198 will operate from ±5V to ±18V supplies. It is available in an 8-lead TO-99 or dual-in-line package.

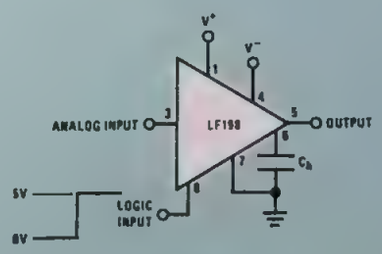
Features

- Operates from ±5V to ±18V supplies
- Less than 10μs acquisition time
- TTL, PMOS, CMOS compatible logic input
- 0.5 mV typical hold step at C_h = 0.01μF
- Low input offset
- 0.002% gain accuracy
- Low output noise in hold mode
- Input characteristics do not change during hold mode
- High supply rejection ratio in sample or hold
- Wide bandwidth

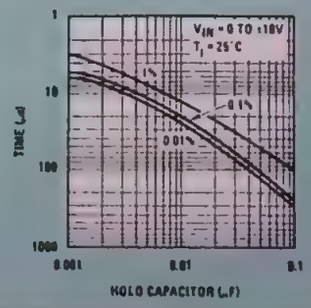
Functional Diagram



Typical Application



Acquisition Time



LM134-3, LM134-6, LM234-3, LM234-6
3-Terminal Adjustable Current Sources

General Description

LM134-3/LM234-3 and LM134-6/LM234-6 are specified as true temperature sensors with guaranteed initial accuracy of ±3°C and ±6°C, respectively. These devices are ideal in remote sensing applications because series resistance in long wire runs does not affect accuracy. In addition, only 2 wires are required.

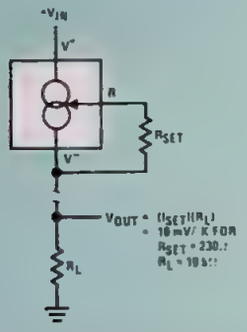
The LM134 is guaranteed over a temperature range of −55°C to +125°C, the LM234 from −25°C to +100°C and the LM334 from 0°C to +70°C. These devices are available in TO-46 hermetic and TO-92 plastic packages.

Features

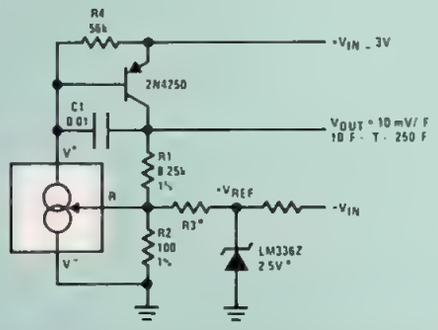
- Operates from 1V to 40V
- 0.02%/V current regulation
- Programmable from 1 μA to 10 mA
- True 2-terminal operation
- Available as fully specified temperature sensor
- ±3% initial accuracy

Typical Applications

Terminating Remote Sensor for Voltage Output



Ground Referred Fahrenheit Thermometer



*Select R3 = V_{REF}/583 μA. V_{REF} may be any stable positive voltage ≥ 2V
Trim R3 to calibrate

LM135/LM235/LM335, LM135A/LM235A/LM335A Precision Temperature Sensors

General Description

The LM135 series are precision, easily calibrated, integrated circuit temperature sensors. Operating as a 2-terminal zener, the LM135 has a breakdown voltage directly proportional to absolute temperature at +10 mV/°K. With less than 1Ω dynamic impedance the device operates over a current range of 400 μA to 5 mA with virtually no change in performance. When calibrated at 25°C the LM135 has typically less than 1°C error over a 100°C temperature range. Unlike other sensors the LM135 has a linear output.

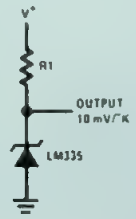
The LM135 operates over a −55°C to +150°C temperature range while the LM235 operates over a −40°C to +125°C temperature range. The LM335 operates from −10°C to +100°C. The LM135/LM235/LM335 are available packaged in hermetic TO-46 packages while the LM235 and LM335 are also available in plastic TO-92 packages.

Features

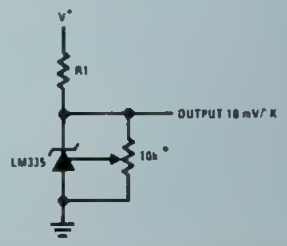
- Directly calibrated in °Kelvin
- 1°C initial accuracy available
- Operates from 400 μA to 5 mA
- Less than 1Ω dynamic impedance
- Easily calibrated
- Wide operating temperature range
- 200°C overrange
- Low cost

Typical Applications

Basic Temperature Sensor



Calibrated Sensor



*Calibrate for 2.982V at 25°C

LM35, LM35C, LM35A, LM35CA, LM35D
Precision Centigrade Temperature Sensors

General Description

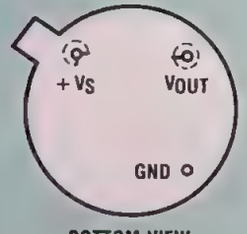
The LM35 series are precision integrated-circuit temperature sensors, whose output voltage is linearly proportional to the Celsius (Centigrade) temperature. The LM35 thus has an advantage over linear temperature sensors calibrated in °Kelvin, as the user is not required to subtract a large constant voltage from its output to obtain convenient Centigrade scaling. The LM35 does not require any external calibration or trimming to provide typical accuracies of ±¼°C at room temperature and ±¾°C over a full −55 to +150°C temperature range. The LM35's low output impedance, linear output, and precise inherent calibration make interfacing to readout or control circuitry especially easy. It can be used with single power supplies, or with plus and minus supplies. As it draws only 60 μA from its supply, it has very low self-heating, less than 0.1°C in still air. The LM35 is rated to operate over a −55°C to +150°C temperature range, while the LM35C is rated for a −10°C to +110°C range (−40°C with reduced accuracy). The LM35 series is available packaged in hermetic TO-46 transistor packages, while the LM35C is also available in the plastic TO-92 transistor package.

Features

- Calibrated directly in ° Celsius (Centigrade)
- Linear +10.0mV/°C scale factor
- 0.5°C accuracy guaranteed (at +25°C)
- Rated for full −55°C to +150°C range
- Suitable for remote applications
- Operates from 4 to 30 volts
- Less than 60 μA current drain
- Low self-heating, 0.08°C in still air
- Nonlinearity only ±¼°C typical
- Low impedance output, 0.1 ohm for 2 mA load

Connection Diagrams

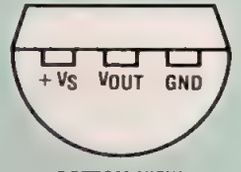
TO-46
Metal Can Package*



BOTTOM VIEW

***Case is connected to negative pin**

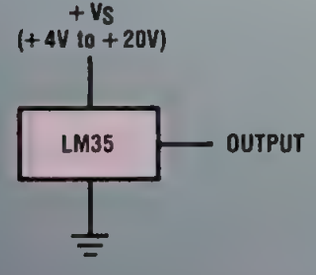
TO-92
Plastic Package



BOTTOM VIEW

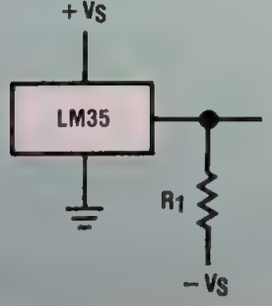
Typical Applications

Basic Centigrade Temperature Sensor (+2°C to +150°C)



0 mV + 10.0 mV/°C

Full-Range Centigrade Temperature Sensor



CHOOSE $R_1 = -V_S/50\ \mu A$

V_{OUT} = +1,500 mV at +150°C
= +250 mV at + 25°C
= −550 mV at −55°C

Data Conversion/Acquisition Circuits
Cross Reference Guide

ANALOG DEVICES	NSC DIRECT REPLACEMENT	NSC FUNCTIONAL REPLACEMENT
AD524JD		LM363D, H
AD524KD		*LM363AD, H
AD524LD		*LM363AD, H
AD537JD		LM331H, N
AD537KD		LM331AH, N
AD537SD		LM131AH
AD562AD/BIN	*DAC1266LCD	
AD562KD/BIN	*DAC1266LCD	
AD562SD/BIN	*DAC1266LCD	
AD563AD/BIN		*DAC1265LCD
AD563KD/BIN		*DAC1265LCD
AD563SD/BIN		*DAC1265LD
AD565AJD/BIN	*DAC1265LCD	
AD565AJN/BIN	*DAC1265LCD	
AD565AKD/BIN	*DAC1265ACD	
AD565AKN/BIN	*DAC1265ACD	
AD565ASD/BIN	*DAC1265AD	
AD565ATD/BIN	*DAC1265AD	
AD565JD/BIN	*DAC1265LCD	
AD565JN/BIN	*DAC1265LCN	
AD565KD/BIN	*DAC1265ACD	
AD565KN/BIN	*DAC1265ACD	
AD565SD/BIN	*DAC1265AD	
AD565TD/BIN	*DAC1265AD	
AD566JD/BIN	*DAC1266LCD	
AD566JN/BIN	*DAC1266LCD	
AD566KD/BIN	*DAC1266ACD	
AD566KN/BIN	*DAC1266ACD	
AD566SD/BIN	*DAC1266AD	
AD566TD/BIN	*DAC1266AD	
AD566AJD/BIN	*DAC1266LCD	
AD566AJN/BIN	*DAC1266LCD	
AD566AKD/BIN	*DAC1266ACD	
AD566AKN/BIN	*DAC1266ACD	
AD566ASD/BIN	*DAC1266AD	
AD566ATD/BIN	*DAC1266AD	
AD570JD		ADC0803LCD
AD570SD		ADC0802LD
AD571JD		ADC1001CCN
AD571SD		ADC1001CD
AD572AD		ADC1210HCD
AD572BD		ADC1210HCD
AD572SD		ADC1210HCD
AD574JD		ADC1210HCD
AD574KD		ADC1210HCD
AD574LD		ADC1210HCD
AD574SD		ADC1210HCD
AD574TD		ADC1210HCD
AD574UD		ADC1210HCD
AD580JH		LM336H
AD580KH		LM336H
AD580LH		LM336H
AD580MH		LM336AH
AD580SH		LM136H
AD580TH		LM136H

ANALOG DEVICES	NSC DIRECT REPLACEMENT	NSC FUNCTIONAL REPLACEMENT
AD580UH		LM136AH
AD581JH		LH0070CH
AD581KH		LH0070CH
AD581LH		LH0070CH
AD581SH		LH0070H
AD581TH		LH0070H
AD581UH		LH0070H
AD582KD		LF398H, N
AD582KH		LF398H
AD582SD		LF198H
AD582SH		LF198H
AD583KD		LF398H, N
AD1408-7D	DAC0807LCJ	
AD1408-8D	DAC0808LCJ	
AD1408-9D		DAC0802LCJ
AD1508-8D	DAC0808LD	
AD1508-9D		DAC0802LD
AD7502KN		LF13509D
AD7502SD		LF11509D
AD7516JN		CD4066BCN
AD7516KN		CD4066BCN
AD7516SD		CD4066BMJ
AD7516TD		CD4066BMJ
AD7520JD	DAC1022LCD	
AD7520JN	DAC1022LCN	
AD7520KD	DAC1021LCD	
AD7520KN	DAC1021LCN	
AD7520LD	DAC1020LCD	
AD7520LN	DAC1020LCN	
AD7520SD	DAC1022LD	
AD7520TD	DAC1021LD	
AD7520UD	DAC1020LD	
AD7521JD	DAC1222LCD	
AD7521JN	DAC1222LCN	
AD7521KD	DAC1221LCD	
AD7521KN	DAC1222LCN	
AD7521LD	DAC1220LCD	
AD7521LN	DAC1220LCN	
AD7521SD	DAC1222LD	
AD7521TD	DAC1221LD	
AD7521UD	DAC1221LD	
AD7522JD		DAC1008LCD
AD7522JN		DAC1008LCN
AD7522KD		DAC1007LCD
AD7522KN		DAC1007LCN
AD7522LD		DAC1006LCD
AD7522LN		DAC1006LCN
AD7522SD		DAC1008LD
AD7522TD		DAC1007LD
AD7522UD		DAC1006LD
AD7524AD		DAC0832LCD
AD7524BD		DAC0831LCD
AD7524CD		DAC0830LCD
AD7524JN		DAC0832LCN
AD7524KN		DAC0831LCN

* To be announced

Data Conversion/Acquisition Circuits
Cross Reference Guide (continued)

ANALOG DEVICES	NSC DIRECT REPLACEMENT	NSC FUNCTIONAL REPLACEMENT
AD7524LN		DAC0830LCN
AD7524SD		DAC0830LD
AD7524TD		DAC0830LD
AD7524UD		DAC0830LD
AD7530JD	DAC1022LCD	
AD7530JN	DAC1022LCN	
AD7530KD	DAC1021LCD	
AD7530KN	DAC1021LCN	
AD7530LD	DAC1020LCD	
AD7530LN	DAC1020LCN	
AD7531JD	DAC1222LCD	
AD7531JN	DAC1222LCN	
AD7531KD	DAC1221LCD	
AD7531KN	DAC1221LCN	
AD7531LD	DAC1220LCD	
AD7531LN	DAC1220LCN	
AD7533AD	DAC1022LCD	
AD7533BD	DAC1021LCD	
AD7533CD	DAC1020LCD	
AD7533JN	DAC1022LCN	
AD7533KN	DAC1021LCN	
AD7533LN	DAC1020LCN	
AD7533SD	DAC1022LD	
AD7533TD	DAC1021LD	
AD7533UD	DAC1020LD	
AD7541AD	DAC1219LCD	
AD7541AJN	DAC1219LCD	
AD7541AAQ	DAC1219LCD	
AD7541ASD	DAC1219LD	
AD7541AKN	DAC1218LCD	
AD7541ABQ	DAC1218LCD	
AD7541ATD	DAC1218LD	
AD7541BD	DAC1218LCD	
AD7541JN	DAC1219LCN	
AD7541KN	DAC1218LCN	
AD7541SD	DAC1219LD	
AD7541TD	DAC1218LD	
AD7570JD		ADC1001CCD
AD7570LD		ADC1001CCD
AD7571JN	ADC1001CCD-1	
AD7571AQ	ADC1001CCD	
AD7571KN	*ADC1001BCD-1	
AD7571BQ	*ADC1001BCD	

HYBRID SYSTEMS	NSC DIRECT REPLACEMENT	NSC FUNCTIONAL REPLACEMENT
DAC331C-10-1	DAC1020LCD	
DAC331C-10-2	DAC1020LCD	
DAC331C-12-1	DAC1218LCD	
DAC331C-12-2	DAC1218LCD	

PMI	NSC DIRECT REPLACEMENT	NSC FUNCTIONAL REPLACEMENT
DAC-03ADX1 (X2		DAC1020LCD
DAC-03BDX1 (X2		DAC1021LCD
DAC-03CDX1 (X2		DAC1022LCD
DAC-03DDX1 (X2		DAC1022LCD
DAC-08AQ	DAC0802LD	
DAC-08Q	DAC0800LD	
DAC-08EQ	DAC0800LCJ	
DAC-08HQ	DAC0802LCJ	
DAC-08CQ	DAC0801LCJ	
DAC-08CP	DAC0801LCN	
DAC-08EP	DAC0800LCN	
DAC-08HP	DAC0802LCN	
DAC-100AA		DAC1020LD
DAC-100AB		DAC1021LD
DAC-100AC		DAC1022LD
DAC-100BB		DAC1020LCD
DAC-100BC		DAC1021LCD
DAC-100CC		DAC1022LCD
DAC-100DD		DAC1022LCD
DAC-12AV	*DAC1266LD	
DAC-12BV	*DAC1266LD	
DAC-12EV	*DAC1266LCD	
DAC-12FV	*DAC1266LCD	
DAC-12GV	*DAC1266LCD	
DAC-12HV	*DAC1266LCD	
SSS1408A-6Q	DAC0806LCJ	
SSS1408A-7Q	DAC0807LCJ	
SSS1408A-8Q	DAC0808LCJ	
SSS1508A-8Q	DAC0808LD	
MUX-88AQ		LF11508D
MUX-88BQ		LF11508D
MUX-88EQ		LF13508D
MUX-88FQ		LF13508D
REF-01AJ		LH0070H
REF-01J		LH0070H
REF-01EJ		LH0070CH
REF-01HJ		LH0070CH
REF-01CJ		LH0070CH
REF-01DJ		LH0070CH
REF-02AJ		LM135H
REF-02J		LM135H
REF-02EJ		LM335H
REF-02HJ		LM335H
REF-02CJ		LM335H
REF-02DJ		LM335H

* To be announced

Data Conversion/Acquisition Circuits
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DATEL/ INTERSIL	NSC DIRECT REPLACEMENT	NSC FUNCTIONAL REPLACEMENT
DAC-08BC	DAC800LCN	
DAC-08BM	DAC0800LCD	
DAC-HZ12BGC	DAC1285HCD	
ADC-HC12BGC		ADC1210HCD
ADC-HC12BMC		ADC1210HCD
ADC-HC12BMR		ADC1210HCD
ADC-HC12BMM		ADC1210HD
DAS952R	ADC0816CCN	
ADC-EK12DC		ADC3511CCN
ADC-EK12DR		ADC3511CCN

TEXAS INSTRUMENTS	NSC DIRECT REPLACEMENT	NSC FUNCTIONAL REPLACEMENT
TL501N		ADC3511CCN
TL505N		ADC3511CCN
TL487N		LN3915N
TL489N		LM3914N
TL490N		LM3914N
TL491N		LM3914N
TL507P		ADC0831CCN
TL520N	ADC0808CCN	
ADC0808J	ADC0808CJ	
ADC0808CJ	ADC0808CCJ	
ADC0808CN	ADC0808CCN	
ADC0809CN	ADC0809CCN	
ADC0816J	ADC0816LD	
ADC0816CJ	ADC0816CCJ	
ADC0816CN	ADC0816CCN	
ADC0817CN	ADC0817CCN	

BURR-BROWN	NSC DIRECT REPLACEMENT	NSC FUNCTIONAL REPLACEMENT
ADC82AG		ADC0820BCD
ADC82AM		ADC0820CCD
ADC85C-12		ADC1001CCD
ADC85-12		ADC1210HCD
DAC82KG		DAC0800LCJ

BURR-BROWN	NSC DIRECT REPLACEMENT	NSC FUNCTIONAL REPLACEMENT
DAC82BM		DAC0800LCJ
DAC82SM		DAC0800LD
DAC682BG-BIN	*DAC1266ADC	
DAC862KG-BIN	*DAC1266LCD	
DAC863BG-BIN	*DAC1265ACD	
DAC863KG-BIN	*DAC1265LCD	
DAC90-BG		DAC0800LCJ
DAC90-SG		DAC0800LD
MP20		ADC0816CCN
MP10		DAC0830LCN
MP11		DAC0830LCN
SHC80KP		LF398H
SHC80BM		LF398H
SCH85		LF398H
SCH298AM	LF398H	
VFC32KP		LM331H
VFC32BM		LM331H
VFC32SM		LM131H
VFC42BP		LM331AH
VFC52BP		LM331AH

MOTOROLA	NSC DIRECT REPLACEMENT	NSC FUNCTIONAL REPLACEMENT
MC1408L6	DAC0806LCJ	
MC1408L7	DAC0807LCJ	
MC1408L8	DAC0808LCJ	
MC1408P6	DAC0806LCN	
MC1408P7	DAC0807LCN	
MC1408P8	DAC0808LCN	
MC1508L8	DAC0808LD	
MC3408L	DAC0806LCJ	
MC3410L		DAC1020LCD
MC3410P		DAC1020LCN
MC3410CL		DAC1021LCD
MC3410CP		DAC1021LCD
MC3412L	*DAC1265LCD	
MC3412P	*DAC1265LCD	
MC3510L		DAC1020LD

* To be announced

Basic Terminology

Data Converter

Accuracy: Sum of all errors: nonlinearity, zero-scale, full-scale, temperature drift, etc. Careful—this term is sometimes confused with resolution and/or nonlinearity.

Conversion Time: The time required for a complete measurement by an A/D converter.

Full-Scale Error: Deviation from true full-scale output when specified reference voltage is applied.

Full-Scale Tempco: Change in full-scale error due to temperature, usually expressed in parts per million per degree (ppm/°C).

Monotonicity: A DAC whose output always increases for increasing digital input codes is said to be monotonic, i.e., does not decrease at any point.

Nonlinearity: Worst-case deviation from the line between the endpoints (zero and full-scale). Can be expressed as a percentage of full-scale or in fractions of an LSB. ±½ LSB is a desirable specification.

Power-Supply Sensitivity: The sensitivity of a converter to DC changes in power-supply voltages is normally expressed in terms of percentage change in analog input value.

Quantizing Error: ±½ LSB error inherent in all A/D converters.

Ratiometric Converter: The output of an A/D converter is a digital number proportional to the ratio of (some measure of) the input to a reference. Most requirements for conversions call for an absolute measurement, i.e., against a fixed reference. In some cases, where the measurement is affected by a changing reference voltage, it is advantageous to use that same reference as the reference for the converter, to eliminate the effect of variation.

Resolution: The most important converter specification. This is the number of steps the full-scale signal can be divided into, and therefore the size of the steps. May be expressed as the number of bits in the digital word, the size of a least significant bit (smallest step) as a percent of full-scale, or an LSB in millivolts (for a given full-scale).

Settling Time: Time from change in input until output remains within ±½ LSB (or some specified percentage) of final output.

3½ Digit BCD: Maximum output count or display is ±1.999 (±2000 counts)— approximately 11 binary bits plus sign.

3¾ Digit BCD: Maximum output count or display is ±3.999 (±4000 counts)—approximately 12 binary bits plus sign.

Bits	Steps (2N)	LSB Size (½ of Full-Scale)	LSB Size (10V Full-Scale)
6	64	1.588%	158.8 mV
8	256	0.392%	39.2 mV
10	1,024	0.0978%	9.78 mV
12	4,096	0.0244%	2.44 mV
14	16,384	0.0061%	0.61 mV
16	65,536	0.0015%	0.15 mV

Multiplexer/Analog Switch

R_{ON}: Resistance between the output and the input of an addressed switch.

I_S: Current at any switch input. This is leakage current when the switch is ON.

I_D: Current at any switch input going into the switch. This is leakage current when the switch is OFF.

C_S: Capacitance between any open terminal "S" and ground.

C_D: Capacitance between any open terminal "D" and ground.

I_D-I_S: Leakage current that flows from the closed switch into the body. This leakage is the difference between the current I_D going into the switch and the current I_S going out of the switch.

t_{ON}: Delay time between the 50% points of an enable input and the switch ON condition.

t_{OFF}: Delay time between the 50% points of the enable input and the switch OFF condition.

Sample and Hold

Acquisition Time: The time required to acquire a new analog input voltage with an output step of 10V. Note that acquisition time is not just the time required for the output to settle, but also includes the time required for all internal nodes to settle so that the output assumes the proper value when switched to the hold mode.

Dynamic Sampling Error: The error introduced into the held output due to a changing analog input at the time the hold command is given. Error is expressed in mV with a given hold capacitor value and input slew rate. Note that this error term occurs even for long sample times.

Gain Error: The ratio of output voltage swing to input voltage swing in the sample mode expressed as a percent difference.

Hold Settling Time: The time required for the output to settle to a % of the final value after the "hold" logic command.

Hold Step: The voltage step at the output of the sample and hold when switching from sample mode to hold mode with a steady (dc) analog input voltage. Logic swing is 5V.

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